Location and Identification of Essential Habitat for Goshawks (Accipiter gentilis) on Six Rivers National Forest

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Identification and Location of Essential Habitat for Nesting Goshawks (Accipiter gentilis) on Six Rivers National Forest

Introduction

This study was designed to investigate the status and habitat use of goshawk (Accipter gentilis) on Six Rivers National Forest, Eureka, California. The Endangered Species Act of 1973 (PL 93-205) mandated all Federal departments and agencies to conserve Threatened and Endangered species. Interim Directives No. 2, January 1978, and No. 5, January 1979, from the Regional Forester, United States Forest Service, Region 5, classified an additional category; Sensitive. Sensitive species were defined as those species of low population density or highly restricted range for which National Forests make up a significant portion of their habitat. Essential habitat was designated as the entire habitat or any portion thereof, if and only if, any constituent element was necessary to the normal needs or survival of that species. The directive outlined special management protection and action for species listed as sensitive to include "...studies to determine occurrence of Theatened, Endangered or Sensitive species and their habitats on Forest lands." Goshawks have been categorized as a Sensitive species since 1978.

These birds could be sighted Forest-wide in the area between the months of September and March; however, the breeding population appeared to be restricted to forested montane areas. This study investigated the area of use during the breeding season. Historically, goshawks have nested in heavily wooded montane regions in dense conifer, hardwood, and woodlands (Dixon and Dixon 1838, Eng and Gullion 1962, Reynolds 1971, Reynolds and Wight 1978,

Schnell 1958) that faced north to east (Reynolds 1971, Shuster 1980). Understories were lacking or sparse in Colorado (Shuster 1980) and in the Sierra Nevada Mountains of California (Schnell 1958); whereas, nests in Oregon were located in areas of dense multi-storied canopies (Reynolds 1975). Historically, there have been problems comparing study results, as well, due to differences in methodologies and terminology. Attempts have been made to standardize terminology and methodologies applied to habitat analysis, including a five level stratification of nesting habitat ranging from geographic range to the nest (Noon et al 1981). Macrohabitat or community patterns (level 2), the nest stand (level 3), the nest site (level 4) and the nest and nest tree (level 5) provided the conceptual framework for nesting habitat characterization by this study.

On-site vegetative, structural and physiographic analyses, levels 3-5, and analysis of community patterns, level 2, were conducted on all active nests within three years of the last known productive breeding season. The introduction, methods, results, discussion and conclusions for each level were reported separately herein. Statistical methods, results and discussion were contained in a separate section. The study was funded through a cooperative agreement with Six Rivers National Forest, administered by the Humboldt State University Foundation.

Study Area

The study area stretched from the California-Oregon state border southward approximately 130 mi (209 km) and varied from 5 to 65 mi (8-105 km) from the

Pacific Ocean (refer to Figure 1). The study concentrated heavily on the 279,994 ac (133,650 ha) of the Mad River Ranger District located in the southern most portion of the Six Rivers National Forest (refer to Figure 1). This area contained 82% of the nest stands. Topography was typified by ridges and intervening water courses oriented southeast to northwest with an elevational range from 1400-6070 ft (744-2044 m) above sea level. Cold, wet winters were succeeded by hot, dry summers. Areas of dense conifer classified according to Kuchler as predominantly Klamath Montane Forest of Douglas-fir (Pseudotsuga menziesii) - tanoak (Lithocarpus densiflorus) - madrone (Arbutus menziesii) covered the region with areas of white fir (Abies concolor) and Ponderosa Pine (Pinus concolor) included. Logging has occurred within the area since the 1940's.

Characterization

I. Level 2 - Community Patterns

A. Nest Stands

1. Introduction

Two types of stands were subjected to level 2 analysis: nest stands and control stands, defined by the presence or absence of a known active nest, respectively. Examination of community patterns, level 2, was undertaken to provide information on the types of habitat found within a two mile (3.2 km) radius of the nest. The boundary theoretically enclosed major foraging sites as well as potential alternate nest stands. The configuration and primary dimension (radius) of the investigated area were suggested in Noon, Fuller and Mosher (1980). Flight range was considered in the selection of radius length. The U.S. Forest Service timber classification system combined with features revealed in previous studies, provided the basis for the habitat classification system employed; tree size and canopy closure had been shown to be relevant components of stand structure (Hall 1980). The distribution of the habitat patches was examined through calculation of Baxter-Wolfe Interdispersion Index (Baxter and Wolfe 1972); a quantitative measure of the number of type changes that occurred along a given intercept system.

2. Methods

The Baxter-Wolfe index method consisted of randomly placing a grid of two perpendicular lines (x) over the type map and recording the number of times a type change was encountered. The scale used was full diameter of the circular boundary. A non-random alignment of the grid lines was used: one line intercept was set parallel to dominant topographic features, generally a pair of ridges with an intervening water course, and the intersection point was located on the nest.

Aerial photographs and on-site data were used to classify the area within a two mile (3.2 km) radius circle. National Forest lands previously had been divided into irregular, multi-sided polygons on 1:24000 scaled maps based on topographic features and timber types. Each polygon was assigned to one of eighteen habitat types according to the following classification system: four non-forested classes; brush, nonvegetated, meadow and clearcut; and fourteen forested classes based on hardwood versus conifer, size class and canopy closure (refer to Table 1, Appendix A). Polygons or agglomerates of polygons of the same type were digitized to yield area using a Tektronics 4052 stand alone computer and a Summagraphics digitizing tablet and control. A Tektronics 4663 interactive digital plotter was employed to verify the digitized results.

3. Results

Level 2 analysis was applied to the ten known nest stands. The mean, standard error and range of values were determined, where applicable, for total acreage, patch size and nearest patch of each type and tabulated in Table 1. Conifer types comprised 4100 ac (1700 ha) or 51% of the total encompassed area. Hardwoods covered 2693 ac (1090 ha) or 33%. Brush was found on 548 ac (222 ha) or 7%, nonvegetated on 389 ac (157 ha) 5%, meadows on 214 ac (87 ha) 13% and clearcuts occupied the remaining 96 ac (39 ha) or 1%. Moderately dense (40-70% canopy closure) small sawtimber conifer accounted for the highest total area (11%). Total acreage of a type ranged from 0 to 9000 ac (0-3644 ha) while the average size of a habitat polygon ranged from 31 to 281 ac (13-114 ha). Pole size hardwood with moderate closure formed the largest stands while dense over-mature conifer remained in very small patches. All habitat types were represented within a maximum of 507 ft (155 m) and an average of 267 ft (81 m) of the nest. The interdispersion index ranged from 35 to 53; an average of 43 type changes occurred.

4. Discussion

Previous studies provided a description of the general goshawk nest stand in the study area as being composed of five acres or more of dense small sawtimber Douglas-fir (C3C). The above mentioned community pattern analyses showed a 62 ac (25 ha) stand of this type within 99 ft (30 m) of a nest tree and an average of four stands

within the area delineated. These patches may have provided potential alternate nesting areas. Potential foraging areas could be found in brush and open hardwood and conifer stands. Pellet analysis and plucking perch remains from nests active during the 1980 breeding season (Cicchetto 1981) showed evidence of Stellers Jays (Cyanocitta stelleri), Mountain Quail (Areortyx pictus) and chickarees (Tamiasciurus douglas). These species frequent coniferous woodlands, open brush and brush/conifer edges, and conifer/hardwood edges, respectively. Those habitats were represented within the 2 mi (3.2 km) radius and distributed throughout the area. The interdispersion index revealed the availability of suitable habitat for prey species associated with edges; a type change or edge occurred every 1060 ft. (323 m).

Grid placement in this study was dictated by topographic features. The grid for the index, if placed randomly, may have provided different information. Configuration of the examined area also should have considered topography. An ovoid would have been suggested by the predominant topography (refer to study area) and may have presented a closer approximation to the foraging patterns of the bird. Telemetry studies were needed to support configuration restrictions and verify actual habitat usage. Further discussion was deferred until presentation of level 2 data for control stands.

5. Conclusions

Goshawks nested in stands located within 507 ft (155 m) of patches of 18 habitat types ranging from nonvegetated to dense over-mature

conifer. Stands varied in size, number and distance from the nest within the area delineated by a two mile (3.2 km) radius circle centered on the nest. The enclosed area was comprised of 51% coniferous forest, 33% deciduous woodland, 7% brush, 5% nonvegetated, 3% meadow and 1% clearcut, thus providing potentially suitable foraging areas and alternate nest stands.

B. Control Stands

1. Introduction

The purpose of control stand sampling was to investigate habitat that apparently matched the traditional description of nesting habitat but remained unoccupied. The stands were subjected to the same analyses as nest stands and resulting sets of data were compared for subtle differences that could elucidate the habitat requirements of nesting goshawks. Results from previous studies were utilized to develop a basic habitat description. The designated control stands were located within the area of concentrated study.

2. Methods

The detailed description of the methods and criteria employed in designating control stands was deferred to the section on level 3 analysis, nest stand description. Previous studies at that level were extensively used in development of the criteria. Community pattern description involved classification, digitizing, plotting

and calculations according to the methodologies outlined for nest stand description, with the exception that the center of the stand was the focal point.

3. Results

Level 2 analysis was applied to ten designated control stands. The mean, standard error and range of values were determined, where applicable, for total acreage, patch size and nearest patch of each type and tabulated in Table 2. Conifer types comprised 4233 ac (1714 ha) 53% of the total encompassed area. Hardwoods covered 2506 ac (1015 ha) or 31%. Brush was found on 449 ac (182 ha) or 6%, nonvegetated on 355 ac (144 ha) or 9%, meadows on 479 ac (194 ha) or 6% and clearcuts occupied the remaining 19 ac (8 ha) or less than 1%. The total acreage of a type ranged from 0 to 2035 ac (0 - 824 ha) while the average size of a habitat polygon ranged from 17 to 107 ac (9 - 43 ha). Moderately dense (40-70% canopy closure) pole size hardwood formed the largest stands while meadows remained in numerous small patches and no stands of dense over-mature conifer occurred. Seventeen habitat types were represented within a maximum of 8035 ft (2450 m) and an average of 2157 ft (658 m) of the center of the control stand. The inderdispersion index ranged from 38 to 62; an average of 51 type chages occurred.

4. Discussion

Previous general nest stand descriptions for the study area included a dense small sawtimber Douglas-fir (C3C) stand five acres or more in size. Level 2 analysis revealed the presence of a 107 ac (43 ha) stand of this type within 228 ft (69 m) of the focal point and an average of seven patches of the type within the area delineated. The C3C patches may have provided potential alternate nesting areas. Patch size and availability exceded the values found for nest stands. The closest stand; however, was twice as far from the focal point but remained within 0.05 mi (0.04 km). Numerous patches of foraging habitat, areas of brush and open hardwood and coniferous woodlands, were located within the two mile (3.2 km) radius. The distance to the nearest potential prey source was shortened but the average size of the foraging area was reduced compared to the equivalent measurements for nest stands. Availability of type changes for prey species associated with edges was indicated by the interdispersion index. Statistical comparisons of the control stand and nest stand data for this level of analysis were not formulated; test results would be inconclusive, due to the limited number of data points available.

5. Conclusions

Visual comparison of the results from level 2 analysis of nest stands and control stands revealed few differences in the distribution of habitat types within the 2 mile radius circle. The

relative percentages of conifer, hardwood and non-forested types were within 1%. The nearest stand of each type was further from the center of the stand in areas around control stands but the delineated area contained comparable number of patches of comparable size. Apparently control and nest stands provided the same alternative nest stand and foraging habitat potential. The study; however, did not provide sufficient information on the prey base available in the potential foraging areas. Further prey base analyses and telemetry studies of habitat use were needed. Such results could be used to determine the configuration of the area examined, in conjunction with topographic features, to assess actual use of each habitat type, and to quantify the potential of foraging areas. The interdispersion index may have been correlated to prey species populations as in Baxter and Wolfe (1979); again, additional data were required.

II. Level 3 - Stand Description

A. Nest Stands

1. Introduction

Examination of stand structure, physiognomy and vegetation was undertaken to provide the necessary information to develop a definition of characteristic nesting habitat and to provide a basis for comparison with other local or geographic areas. Two types of stands were subjected to level 3 analysis: nest stands and control stands. They were defined by the presence or absence of a known active nest, respectively. Nest stand definition was refined further to that area of contiguous stand structure containing the nest tree, alternate nest tree and plucking perches.

2. Methods

Aerial photographs and on-site reconnaissance were employed to establish the boundaries of the contiguous stand. Stand description involved stratified random sampling of vegetation, structure and physiognomy; the habitat within the delineated area was sampled using randomly placed plots within that area (Mueller-Dombois and Ellenberg 1974). Tenth acre (.04 ha) circular plots, 37.2 ft (11.3 m) in radius, were located randomly with respect to distance and direction from an initial plot centered at the nest tree. Eight points of the compass were assigned numerical values as follows:

1-N, 2-NE, 3-E, 4-SE, 5-S, 6-SW, 7-W, 8-NW. A point was chosen on a random number table. The four numbers following that point were extracted. The first digit was used to designate direction of travel; the next three were treated as a three digit number to determine the distance travelled in feet. Succeeding plots were chosen by repetition of the four digit extraction on subsequent entries in the table. No sampling was conducted within 50 ft (15 m) of a defined stand boundary to avoid sampling within transition zones.

The vegetation, physiognomy and structure of the stands were sampled by twenty-eight variables measured in each plot (refer to Appendix B). Diameter at breast height (DBH) and stems per acre were recorded, where applicable, for overstory, understory and snag species. The number of canopy strata was defined by the distribution of diameter size classes (refer to Table 4, Appendix A). Tree height and height of lower canopy of three trees in each strata, slope and basal area were measured using a Spiegel Relaskop. Total canopy closure was assessed with a spherical densiometer while closure attributable to each strata was estimated as a percentage of the total closure. Seven categories of ground cover; herbaceous vegetation, woody vegetation (shrub), rock, bare ground, litter and two size classes of dead and down material were measured along a 900 inch (22.9 m) line intercept that transected the plot center perpendicular to the slope gradient. Determination of major aspect was made with a compass. Decadence ratings were assigned in accordance with the U.S. Forest Service Compartment Inventory and

Analysis Handbook (refer to Table 3, Appendix A). Decadence inferred the loss of trees from the overstory and the presence of disease or indicators of loss of vigor when used in reference to stand condition. Elevation was recorded from a Thommen altimeter calibrated daily. Field measurements were augmented by calculation of average DBH, tree height, lower canopy height, and canopy depth and canopy closure per strata. Refer to Appendix A for detailed information on techniques, terminologies and criteria used.

A minimum of five plots were analyzed. The number of plots necessary to characterize a stand was determined through calculation of the coefficient of variation of the mean for the stems of Douglas-fir trees per plot (refer to Equation 1). The coefficient of variation of the mean was used as a measure of the error entailed in the estimate of the mean. The data collected was considered sufficient when one of the following criteria was met:

a. the coefficient of variation was less than or equal to 0.1;

b. the same value of the coefficient of variation had been calculated at three consecutive plots;

c. ten plots had been sampled.

Equation 1. Calculation of the coefficient of variation of the mean (%SEM).

$$\frac{\frac{\sum X^2 - \frac{(\sum X)^2}{N}}{N(N-1)}}{\bar{X}}$$

Where:

X = number of Douglas-fir trees in plot

N = number of plots Douglas-fir trees per plot

$\bar{X}$ = mean number of Douglas-fir trees per plot

3. Results

Level 3 analysis was applied to all known nest stands. The mean/mode, standard error and range of values were determined, where applicable, and tabulated for each stand (refer to Appendix C) and for all nest stands combined (refer to Table 3). Various hardwood components (10%) were scattered through stands of dense, small sawtimber Douglas-fir (refer to Figure 2). Canopy closures exceeded 84% in stands ranging from 4 to 74 ac (1.6-30 ha). Stem density varied widely; live stems per acre ranged from 30 to 510 (12-206 stems per hectare) while basal area measured between 160 and 641 ft^2/ac. Stands typically were single-storied, although multi-storied plots occurred. Litter and small dead and down material provided ground cover thus creating a park-like understory. Slopes varied from 4-87%. The highest and lowest elevations recorded were 3560 ft (1085 m) and 1620 ft (494 m), respectively. Aspect varied from northwest to west; however, the birds preferred north and east facing slopes (refer to Figure 3). These were young, vigorous even-aged stands with sparsely distributed mature and overmature timber.

4. Discussion

The general nest stand characteristics which emerged from analysis supported and refuted results from previous studies. Stands generally were:

a. dense (canopy closure above 70%),

b. exposed in a north to east direction, except in Alaska,

c. located on moderate slopes, and

d. of moderate size (average stand area = 25 ac (10 ha)).

This summary was similar to stands described variously in Oregon, Minnesota, Alaska and Colorado by Reynolds (1971, 1975), Gullion (1981), McGowan (1975) and Shuster (1976, 1980).

The following physiographic and structural differences appeared:

a. Stands were single-stories with little or no understory in northwestern California and Colorado while Oregon contained multi-storied stands.

b. Overstory trees were classified as predominantly small sawtimber (41%) rather than large old-growth (over-mature) as those in Colorado and Oregon, although the upper canopy layer in multi-storied plots would have been classified as mature.

c. Ninety percent of the stands were found at elevations below nests in Colorado but higher than those in Alaska.

d. Dominant species were coniferous in Oregon and northwestern California, deciduous in Alaska and both were represented in Colorado.

5. Conclusions

Nesting goshawks chose to construct nests in dense, single-storied stands of small sawtimber Douglas-fir facing north to east on moderate slopes. Litter and small dead and down material provided ground cover under a park-like understory. These results agreed and disagreed with previous studies in other locations thus illustrating a variability in habitat suitable for nesting and the ability of the birds to adapt to regional differences. Further discussion and conclusions were deferred for presentation of level 3 control stand data and level 4 nest site data (refer to Comparison Section for the deferred comparisons).

B. Control Stands

1. Introduction

The purpose of control stand sampling was to investigate habitat that apparently fit the traditional description of nesting habitat but remained unoccupied. The stands were subjected to the same analyses as nest stands and the resulting sets of data were compared for subtle differences that could elucidate the habitat requirements of nesting goshawks. The absence of any nest known to have been active placed further restriction on control stand definition to eliminate stands which may have been inactive temporarily. Results from previous studies were utilized in development of a basic habitat description. The designated control stands were located within the area of concentrated study.

2. Methods

A stratified random procedure was used to choose control stands within the area of concentrated study. Stand area, structure, stem density and dominant tree size class were available for the district from previous timber type analysis. The information was overlaid on 1:24000 U.S.G.S. quadrangles.

The criteria for acceptance of a control stand were:

a. larger than five acres in area;

b. dominated by conifers larger than 10.9 inches in diameter;

c. canopy closure exceeded 70%;

d. predominantly single-storied structure; and,

e. faced northwest to east.

The criteria were based on data gathered on nesting area the previous year and traditional descriptions of nesting habitat. Each control stand was located on a quadrangle and assigned a number. Ten numbers were drawn at random from the pooled results. Aerial photographs and on-site reconnaissance were employed to establish the boundaries of the contiguous stand. Stand description involved sampling of vegetation, structure and physiognomy according to the methodologies outlined for nest stand description with the exception that the initial plot was centered at the center of the stand.

3. Results

Level 3 analysis was applied to ten control stands. The mean/mode, standard error and range of values were determined, where applicable, and tabulated for each stand (refer to Appendix C) and for all control stands combined (refer to Table 4). Various hardwood components (5%) and mature timber (20%) were scattered through stands of dense small sawtimber Douglas-fir (refer to Figure 4). Canopy closures exceeded 72% in stands ranging from 14 to 62 acres (6-25 ha). Stem density varied widely; live stems per acre ranged from 50 to 340 (200-138 stems/ha) while basal area measured between 200 and 640 ft^2/acre. Stands typically were single-storied, although multi-storied plots occurred. Litter and small dead and down material provided ground cover thus creating a park-like understory. Slopes varied from 1 to 60%. The highest and lowest elevations recorded were 3890 ft (1186 m) and 2735 ft (834 m), respectively. Stand aspect varied from northwest to east; however, some plots were located facing west due to topographic features within the stands (refer to Figure 5). These were young, vigorous even-aged stands.

4. Discussion

The general stand characteristics which emerged from analysis appeared to fulfill the criteria set for control stand and approximated general nest stand description. Stands were dense (canopy closure above 70%), vigorous, single-storied small sawtimber Douglas-fir with scattered hardwood components. Controls were

located on moderate slopes facing north to east. Area averaged in the mid-twenties acres. Basal area, altitude and ground cover remained within the same ranges as found in the nest stands, while the range of stems per acre was wider.

5. Conclusions

Control stands approximated the structural, vegetative and physiographic features of nest stands; thereby meeting the study criteria. Refer to the Comparison Section for further comparisons of control and nest stand characteristics.

II. Level 4 - Nest Site Description

A. Introduction

Intense examination of the nest site structure, physiognomy and vegetation was undertaken to provide the information necessary for development of a definition of characteristic habitat and to provide a basis for comparison with other local or geographic areas. Previous studies generally have referred to nest site as the area immediately adjacent to the nest tree. This study restricted nest site definition to the 0.1 ac (0.04 ha) surrounding the nest tree. The presence of horizontal surfaces (stumps, logs, or low-hanging branches) for prey plucking perches was common to descriptions of known nest sites by Eng (1962), Reynolds, (1971), Schnell (1958), and Shuster (1976). Canopy openings adjacent to the nest tree were reported by Shuster (1980) and Hall (1980). Analyses of plucking perches and canopy openings within 100 ft (30 m) of the nest tree augmented the on-site sampling.

B. Methods

Nest site analysis included on-site sampling of all level 3 vegetative, structural and physiographic attributes (refer to Appendix B) in a plot centered at the nest or alternate nest tree, augmented by additional analysis of plucking perches and canopy openings. The elevation, height, species and condition of the perch as well as the distance, direction and slope position with repsect to the nest tree were noted. Cause, size and relationship to the nest tree were described for each canopy opening. Techniques and terminologies have been incorporated in Table 5, Appendix A.

C. Results

Level 4 analysis was applied to all 12 nest sites known to have contained active nests at least once in the preceeding three breeding seasons. The mean/mode, standard error and range of values were determined, where applicable, and tabulated in Table 5. Various hardwood components were scattered through sites of dense pole size Douglas-fir (refer to Figure 6). Canopy closure exceeded 60% and averaged 88%. Basal area ranged widely from 189 to 520 ft^2/ac while live stems per acre measured between 50 to 170 (20-69 stems/ha). Nest sites were typically multi-storied, although single-storied sites occurred. Litter and small dead and down material provided ground cover thus continuing the park-like understory throughout the nesting area. Slopes varied from 11 to 80%. Aspects were measured through 270 degrees, not including south; however, the majority of the sites faced east (refer to Figure 7). The sites were comprised of mature, decadent timber (81%) with scattered over-mature trees (19%).

The mean/mode, standard error and range of plucking perch and canopy opening values were determined, where applicable, and tabulated in Table 6. Two plucking perches were found upslope and above the nest 50 ft (15 m) from the nest tree and 59 ft (18 m) above ground. A 1212 ft^2 (114 m^2) canopy opening caused by downed trees generally was found downslope adjacent to the nest tree foliage. No aspect was predominant.

D. Discussion

The general characteristics that emerged from analysis provided a description containing attributes from contrasting studies, again providing evidence of the variability in nest sites acceptable to the species. Evidence of adaptability was found in the location of nest sites in both coniferous and deciduous woodlands in Alaska and Minnesota. Comparisons of vegetative and structural features herein were restricted to studies also conducted in coniferous forest. There appeared to be an overall preference for high canopy closure, areas of larger timber and north to east facing slopes, excepting Alaska. Sites in Colorado retained a uni-layered canopy structure; whereas, nests were located in areas of multi-layered canopy in Colorado, Oregon and northwestern California. Moderate slopes or benches were preferred in other study areas but not in this study. Shuster's findings (1980) confirmed the absence of vegetative ground cover and an opening in the canopy immediately adjacent to the nest tree; Reynolds did not report an analogous situation in Oregon. High stem density prevailed in Oregon but not in Colorado where basal area measured between 30 and 90 ft^2/acre. The discrepancies listed may be attributed to regional differences in the available habitat.

E. Conclusions

Goshawks nesting on Six Rivers National Forest chose nest sites of dense, slightly decadent, multi-storied large sawtimber Douglas-fir. High stem density and canopy closure, north to east facing moderate slopes, park-like understory, several plucking perches and a canopy opening

adjacent to nest tree foliage generally characterized the tenth acre (0.04 ha) surrounding the nest tree. Refer to the Comparisons Section for further discussion and conclusions.

III. Level 5 - Nest Tree Description

A. Introduction

Examination of the structural features of nest and nest tree provided data for determination of the potential of other trees as nesting substrate. The presence of running water in the stand was listed as a characteristic of primary importance by Reynolds (1971), Bond (1940), and Dixon and Dixon (1938). Human disturbance during the courtship, nest building and incubation phases of breeding has induced desertion of the nest, thus, the productivity of an acceptable site decreased. Productivity and/or suitability of a nest could be reduced by the presence of other occupied nest sites in the area. Proximity analyses were conducted to yield information on nest location with respect to other nesting areas and sources of disturbance and water to compare with similar analyses conducted on central points of control stands. The comparisons were implemented to reveal subtle aspects of nest location.

B. Methods

Aerial photographs, on-site reconnaissance and maps were used to conduct proximity analyses for nest and control stands: permanence and class of water sources and type and level of use of disturbances (refer to Table 6, Appendix A) were noted. Distances were measured from the nest tree or from the center of the stand. Values were included for alternate nests when active status had been verified. Distance to nearest nest was included only for nests located in the area of concentrated study, where

extensive surveys had been conducted. Nest tree analysis involved detailed on-site descriptions of all nests and nest trees. Structural and vegetative features of the nest tree including diameter at breast height, species of tree, tree height, lower canopy height, canopy layer membership, decadence and position on slope were noted. Information on nest construction and support and the relationship of the nest to structural features of the nest tree and nest site was gathered. Techniques, terminologies and methodologies have been detailed in Appendix A.

C. Results

Level 5 habitat analysis was applied to twelve nests, alternate nests and the trees they were built in. Twenty-five tree and nest variables were measured. Field data were augmented by calculation of the nest tree canopy depth, relationship of nest to surrounding site canopy and the proximity analyses. Mean/mode, standard error and range of values were computed, where applicable, and tabulated in Table 7. Stick nests were constructed facing north to east on the downslope side of the tree immediately adjacent to the trunk of Douglas-firs, with the exception of one nest built in a madrone. Nest height averaged 69 ft (21 m) above ground, thus generally placing the nests below the nest tree canopy but within the lower quarter of the overall site canopy. Nests generally were supported by three dead branches 13 ft (4 m) in length and four inches (10 cm) in diameter. Canopy closures above the nest proved consistent with closures in the site. Nest trees averaged 141 ft (43 m) in height, were of medium decadence and had a diameter of 36 in (91 cm). The nearest tree to the nest tree was found within 4 to 22 ft (1-7 m).

A proximity analysis was conducted on 13 nest trees and central points in 10 control stands. Mean/mode, standard error and range of values were calculated where applicable, and presented in Table 8. The nearest source of water ranged from immediately below the nest to 2310 ft (704 m) while the nearest source of disturbance was located 100 to 4375 ft (30 - 1333 m) from the nest tree. Nests generally were built within 502 ft (153 m) and 916 ft (279 m) of a source of water and disturbance respectively. Water sources primarily occurred as intermittent class streams within the stand. Control stand centers were located within 0-3750 ft (0-1143 m) of water and 0-3960 ft (0-1207 m) of a disturbance. The nearest water source and disturbance generally were found within 971 ft (349 m) and 979 ft (298 m), respectively. Intermittent class streams within or along stand boundaries were the nearest sources of water. Lightly used roads provided the source of most disturbance to both stand types. Nest trees and control stand centers were located within 4 mi (6 km) and 6 mi (10 km) of the nearest nest. Distance to the nearest nest ranged from 1-14 mi (2-23 km) and 0.2-133 mi (3-21 km) for nest and control stands, respectively.

D. Discussion

Nests were constructed predominantly in hardwoods in Alaska and conifers in Oregon and northwestern California and in both hardwoods and conifers in Minnesota and Colorado. Average height above ground ranged from 23 to 114 ft (7-35 m) depending upon the species of conifer, as did the average tree size. Shuster also noted nest positioning below and within the canopy adjacent to the trunk. Construction of nests below the canopy may have increased ease of access. All nest tree diameters measured within

the mature large sawtimber class while 50% classified as over-mature timber. The average diameter coupled with a medium level of decadence provided the only tie between goshawks and over-mature Douglas-fir forest, contrary to findings in Colorado and Oregon. Analyses of nest support strengthened the theory that over-mature trees were required to provide sufficiently firm nesting substrate. Nests additionally were positioned adjacent to the trunk where limbs were the stoutest.

The presence of water through earlier phases of breeding has been stressed as an important factor in nest location. The benefits of increased humidity and decreased temperature due to water within the stand was not clarified by this study; the separation between nest and closest source varied from immediately below to over 2000 ft (357 m), a range comparable to that found in Colorado. Distance to disturbances have not been discussed in previously mentioned studies; although the most sensitive time of the breeding season has been defined as the courtship, nest building and incubation phases (Reynolds 1971). The separation between nest and disturbance also varied widely, thus failing to add any resolution to conflicts between possible disturbance and nest protection.

E. Conclusions

Goshawks breeding in the forest generally constructed stick nests 69 ft (21 m) above ground, below or within the lower quarter of the canopy immediately adjacent to the trunk on the downslope side of the tree, facing north to east. The nests were positioned for ease of access and maximum support in large over-mature Douglas-firs near three intermittent streams and lightly used roads.

IV. Summary

Goshawk nesting habitat on Six Rivers National Forest was characterized as follows:

1.	Species	Predominantly Douglas-fir with scattered hardwood components (8-10%);
2.	Aspect	Northwest to east for stands, sites and nest;
3.	DBH	High range small sawtimber (18 in) in even-aged stands and low range mature, large sawtimber (23 in) at nest sites with over-mature nest trees;
4.	Basal area	Relatively consistent throughout the stands and average 393 ft^2/acre;
5.	Stems per acre	Lower at nest sites than within the stand (113 and 173, respectively);
6.	Canopy closure	Lower at nest sites (88%) than within stands (94%) due to a canopy opening immediately adjacent to the nest tree foliage, but greater than 70% throughout;
7.	Canopy structure	Tree heights (127-170 ft), lower canopy heights (79-86 ft) and canopy depths (48-85 ft) in the predominantly single storied stands were comparable with the multi-layered sites;
8.	Decadence	Low throughout stands with a trend towards increased decadence in the tenth acre surrounding the nest tree;
9.	Ground cover	Park-like throughout, predominantly litter (357-410 in) and small dead and down material (207-234 in) with a lower herbaceous vegetation component (21%)(113-156 in);
10.	Additional Structures	Scattered mature (21%) and over-mature (7%) trees throughout the stand; several plucking perches upslope in close proximity to the nest tree;

11. Additional Requirements Potential foraging areas and alternate nest stands were found within a two mile (3.2 km) radius of the nest.

Goshawk nests were characterized as being constructed of sticks and generally placed:

1. between 31 and 92 ft (9-28 m) above ground,
2. below or within the lower quarter of the canopy,
3. with high canopy closure directly above,
4. adjacent to the trunk on the down slope side of an over-mature Douglas-fir,
5. supported by at least three limbs, and
6. within 0.8 mi (1334 m) of an intermittent stream and a lightly used road.

Nests were found in large trees in canopy openings in stands of dense, vigorous, even-aged young Douglas-fir.

Intra and Inter-Level Comparisons

I. Level 2 - Nest Stands Vs. Control Stands

A. Introduction

Analyses of control stands were used to provide comparative values for nest stand analyses results, in an attempt to elucidate subtle aspects of stand characterizations. Two methods of comparison were considered: univariate approach to examine differences for individual variables and a multivariable approach for simultaneous comparison of whole data sets. Discriminant function analysis provided a multivariate technique for sets of variables which was preferable to a serial application of univariate tests due to the error compounded and associated with each comparison.

B. Methods

Scatterplots were used to examine relationships between all variable pairs. Mean/mode, standard error, kurtosis and skew were calculated for each distribution. Aspect was recoded into three binary variables: aspect between NW and NE, aspect between NE and SE, and aspect between SW and NW. A univariate analysis of variance (ANOVA) was employed to test the equality of means of parametric data and a Chi-square test was applied similarly to non-parametric data. Data reduction was implemented to achieve criteria for the minimum ratio of observations to number of variables and for independence of variables for multivariate techniques (Green 1979). Data classified irrelevant or redundant were removed from

further analysis. Variables were considered irrelevant if quantification had been possible in ten or less percent of the plots. Aggregation of several measurements provided an alternative to removal. Groups of repetitive measurements were identified through principal component analysis and examination of correlation tables. The variable in the intercorrelated group that was considered most pertinant to the animal's ecology was retained. Stepwise and jack-knife discriminant analyses were applied to the data for the resulting variables (Cooley and Lohnes 1971, Dixon et al 1978, respectively). The jack-knife analysis yielded the most conservative estimate of the ability to distinguish between the categories that were compared while stepwise analysis provided the best possible separation. All statistical procedures were conducted using the Statistical Package for the Social Sciences (SPSS) (Nie et al 1975, Nie and Hull 1977) excepting jack-knife discriminant analysis which was conducted using Biomedical Data Package (BMDP)(Dixon et al 1979). Both statistical packages were implemented on a Cyber 170 located on the Humboldt State University campus.

C. Results

All variables proved linearly related and were subjected to reduction procedures. Nine variables were retained after aggregation, examination of correlation tables and factor analysis. Analysis included the presence of aspect between northwest and northeast, the presence of aspect between southwest and northwest, total canopy closure, basal area, average overstory canopy depth, inches of live vegetative ground cover, inches of rock and bare ground, number of canopy strata and number of

snags per acre. All nine were measured directly or were first order linear combinations of field measurements and comprised the discriminant analysis data set. All differences described were considered significant ($P \leq 0.05$ level) unless otherwise indicated.

A comparison of nest stand and control stand characteristics with a series of univariate ANOVA's revealed significant differences, as well as similarities, despite the apparent equivalence:

1. Aspects, area and altitudes measured within the same ranges.
2. Nest stands were located on steeper slopes.
3. Stand quality in terms of decadence was significantly lower where nests were located ($P \leq .01$) (refer to Figure 8). This was augmented by the larger number of over-mature trees per plot in nest stands ($P \leq .01$).
4. Tree heights, lower canopy heights and canopy depths remained within the same ranges as did canopy structure; single-storied stands prevailed (refer to Figure 9).
5. Stem densities as described by basal area were comparable; however, snag, total live and Douglas-fir densities measured as stems per acre were lower in stands containing nests.
6. The relative composition of ground cover shifted slightly. Small dead and down material and litter consistently provided the most ground cover; however, more vegetation was found growing in nest stands.
7. The increased diameter at breast height from control stand to nest stand proved highly significant ($P \leq .01$) (refer to Figure 10). This was reflected in the larger number of over-mature trees scattered throughout stands containing nests (refer to point 3).
8. The increase in canopy closure from control to nest stand (refer to Figure 11) also proved highly significant ($P \leq .01$).

Discriminant function analysis produced a function weighted heavily on total canopy closure and inches of vegetative ground cover. Group separation as measured by the correct classification of plots was high

for both the stepwise procedure (85%) and the jack-knife procedure (83% correctly separated).

D. Discussion

The attempt to standardize specific characteristics for intralevel comparisons were partially successful; stand size, aspect, dominant species and canopy structure did not differ. The two stand types were significantly different; however, based on the fifth criterion, canopy closure, and the ground cover composition, which had not been controlled for. The basis for the discrimination was a difference of only eight percent in average closure which suggested high sensitivity to the amount of solar penetration or to the concommittant temperature. High canopy closures and tree densities, north to east exposures, and positioning low on slopes and close to water would reduce temperature and increase humidity within the stand. Stand density was higher in the stands lacking nests. The increased density was coupled; however, with lowered average diameter, decadence, organic debris (litter and dead and down material) and number of large mature trees; indicative of young vigorous stand with reduced available nest support.

E. Conclusions

Level 3 analysis showed that goshawks nested in cool, moist, young, vigorous, dense Douglas-fir stands exposed north to east. Level 5 analysis provided evidence that nests were constructed in the scattered over-mature trees. The comparison of control stands to nest stands

further implied that there were lower limits to the acceptable age and vigor of stands, as indicated by diameter, decadence and debris, to availability of large old-growth trees for firm nest support, and to canopy closure. The control stands examined in this study met the basic criteria but proved to have been younger than the stands used for nesting and; therefore, lacked some of the more subtle characteristics. The absence of the mentioned characteristics possibly explained the absence of nesting goshawks; however, the absence of prey base analyses prevented any definite conclusions. The resulting stand characterization provided predictive attributes and supplied the information necessary to conclude that the stands could be produced on Six Rivers National Forest by current silvicultural prescriptions and techniques.

II. Level 3 vs. Level 4 - Nest Stands vs. Nest Sites

A. Introduction

The comparison of nest stand and nest site characteristics was suggested by on-site observations of apparent structural differences between the two levels of habitat. Quantification of the characteristics permitted statistical tests of equality between the area immediately surrounding the nest tree and the stand the nest site was located in. Significant differences would have provided supportive evidence for theories derived from field observations, variables to measure and appropriate techniques for quantification of the variables. This study examined the ability of the developed methodologies to distinguish structural and vegetative variations and to clarify subtle aspects of goshawk nesting habitat.

B. Methods

All methodologies outlined for the comparison of nest stand to control stand results were employed in the comparison of nest stands to nest sites. The same variables were measured and the data were subjected to the reduction and discrimination techniques as described in the previous section.

C. Results

A comparison of the results from stand and site descriptive analyses was made. The following points were revealed by univariate ANOVA conducted on each independent variable:

1. Stand quality in terms of decadence appeared of more importance than site quality (refer to Figure 8).

2. Aspects, slopes and altitudes measured within the same ranges.

3. The nesting birds were found in multi-storied nest sites within single-storied stands. The difference was significant ($P \leq .05$) (refer to Figure 9).

4. The relative composition of ground cover did not vary; the parklike understory was consistent throughout the stand.

5. Total live and Douglas-fir densities measured as stems per acre were higher in the stands than in the 0.1 acre surrounding the nest tree. Stem density measured as basal area showed no difference between the two levels of analysis.

6. The increase in diameter at breast height from nest stand to nest site proved highly significant ($P \leq .01$) (refer to Figure 10). This was reflected in the higher number of trees measuring 36 or more inches in diameter in close proximity to the nest tree.

7. The decrease in total canopy closure from stand to site (refer to Figure 11) also proved highly significant ($P \leq .01$).

8. Tree height, lower canopy height and canopy depth were comparable.

Discriminant function analysis again included the number of canopy strata, presence on north facing slopes, presence on west facing slopes, average depth of overstory canopy, number of snags per acre, total canopy closure, basal area, inches of vegetative ground cover and inches of bare ground or rock ground cover. The resultant function from the stepwise procedure weighted heavily on total canopy closure. Group separation as measured by the correct classification of plots was high (85%) for the stepwise procedure function; however, the jack-knife procedure function correctly separated a slightly lower percent (80%) of the plots.

D. Discussion

Nest sites were areas of decreased canopy closure, stem density and vigor and increased canopy complexity and stem diameter within homogenous

stands; structural differences that were discernable in the field and supported conclusively by statistical analyses. The changes may have been explained by requirements for firm nest support and nest accessibility.

E. Conclusions

There were definite visual and statistical differences in structure between the area immediately surrounding the nest tree and the stand containing the nest site. The methodologies developed by the study proved able to distinguish both obvious and subtle structural differences.

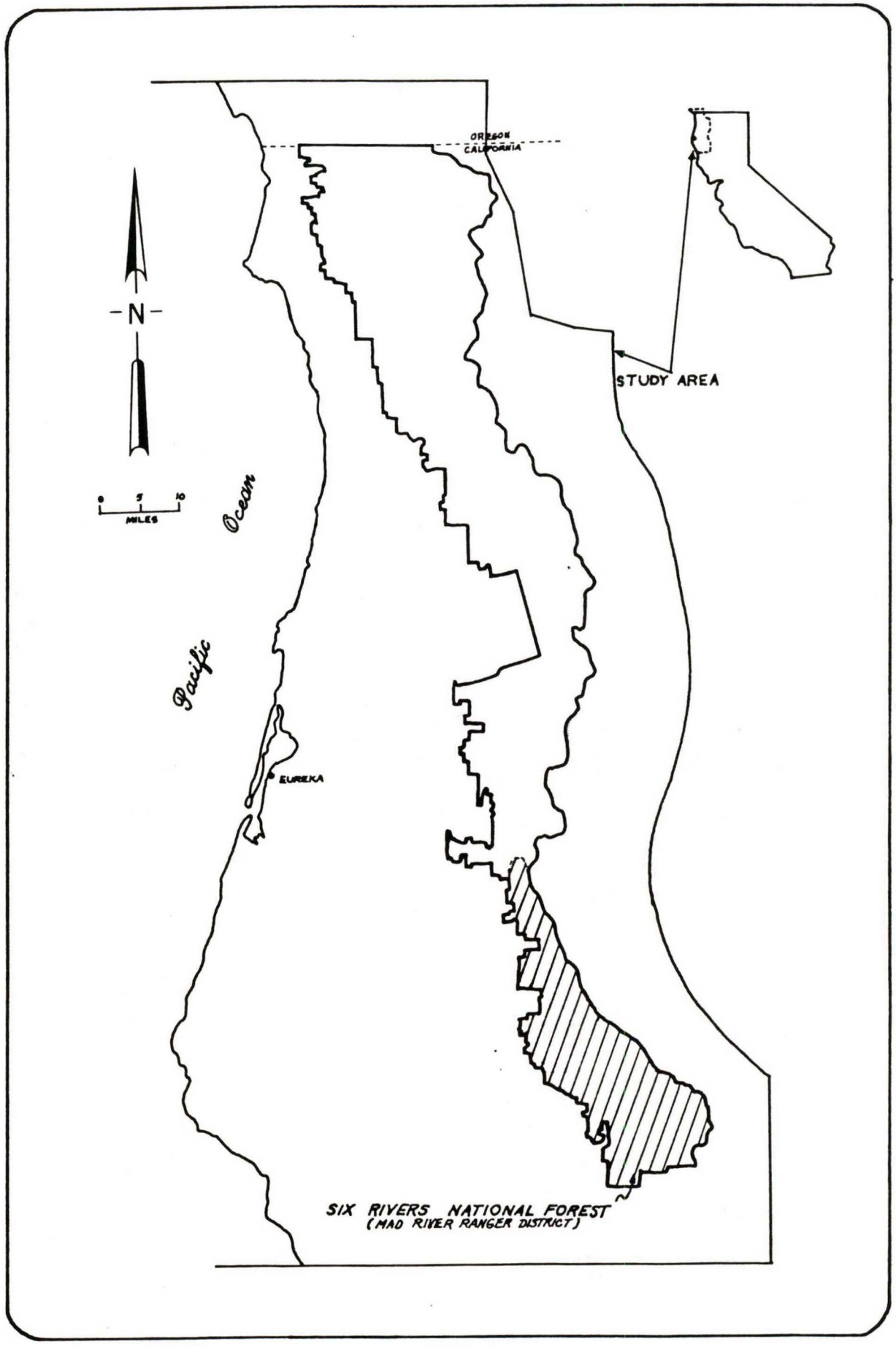

Figure 1. Study area.

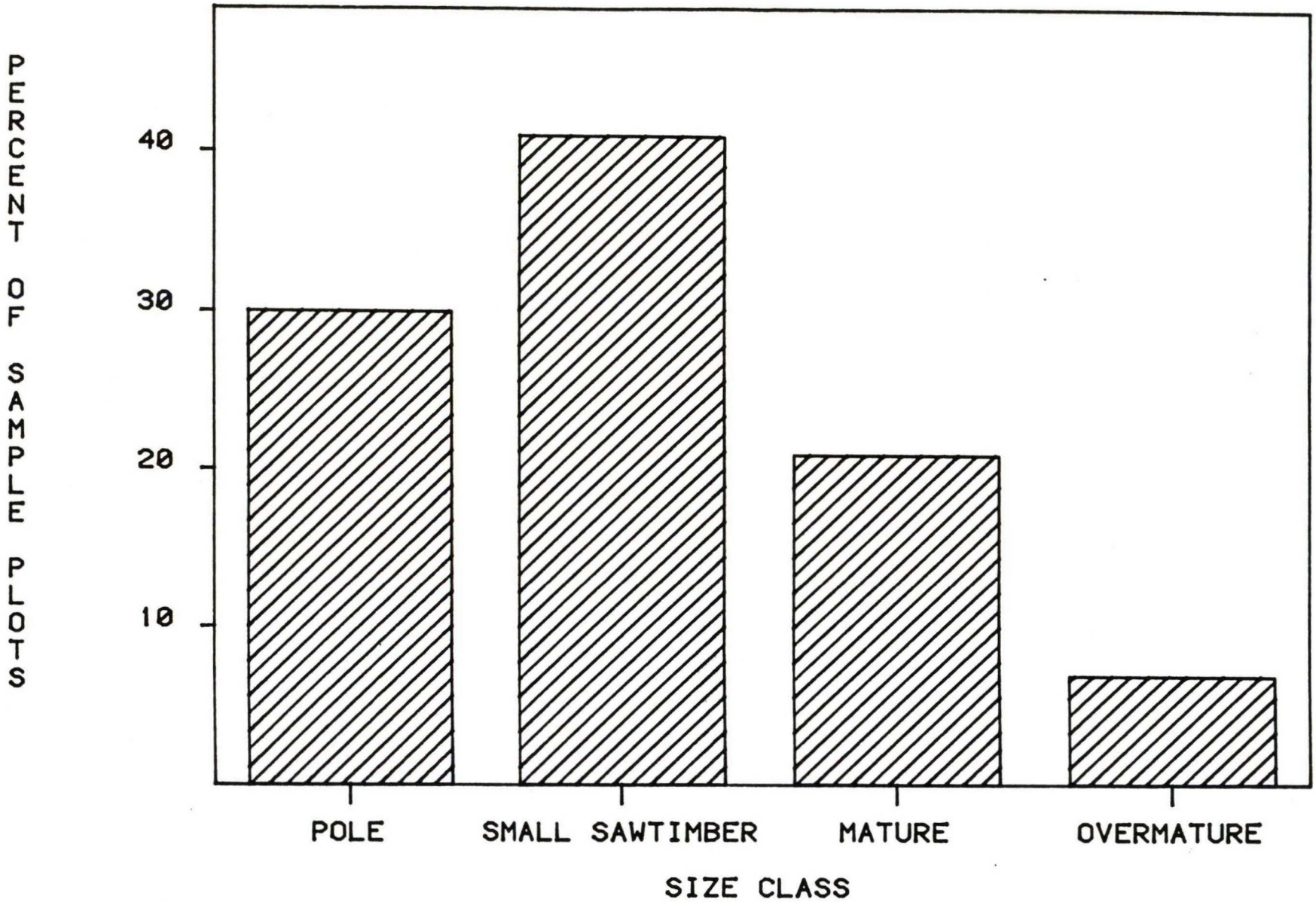

Figure 2. Size class distribution of Douglas Fir in nest stands.

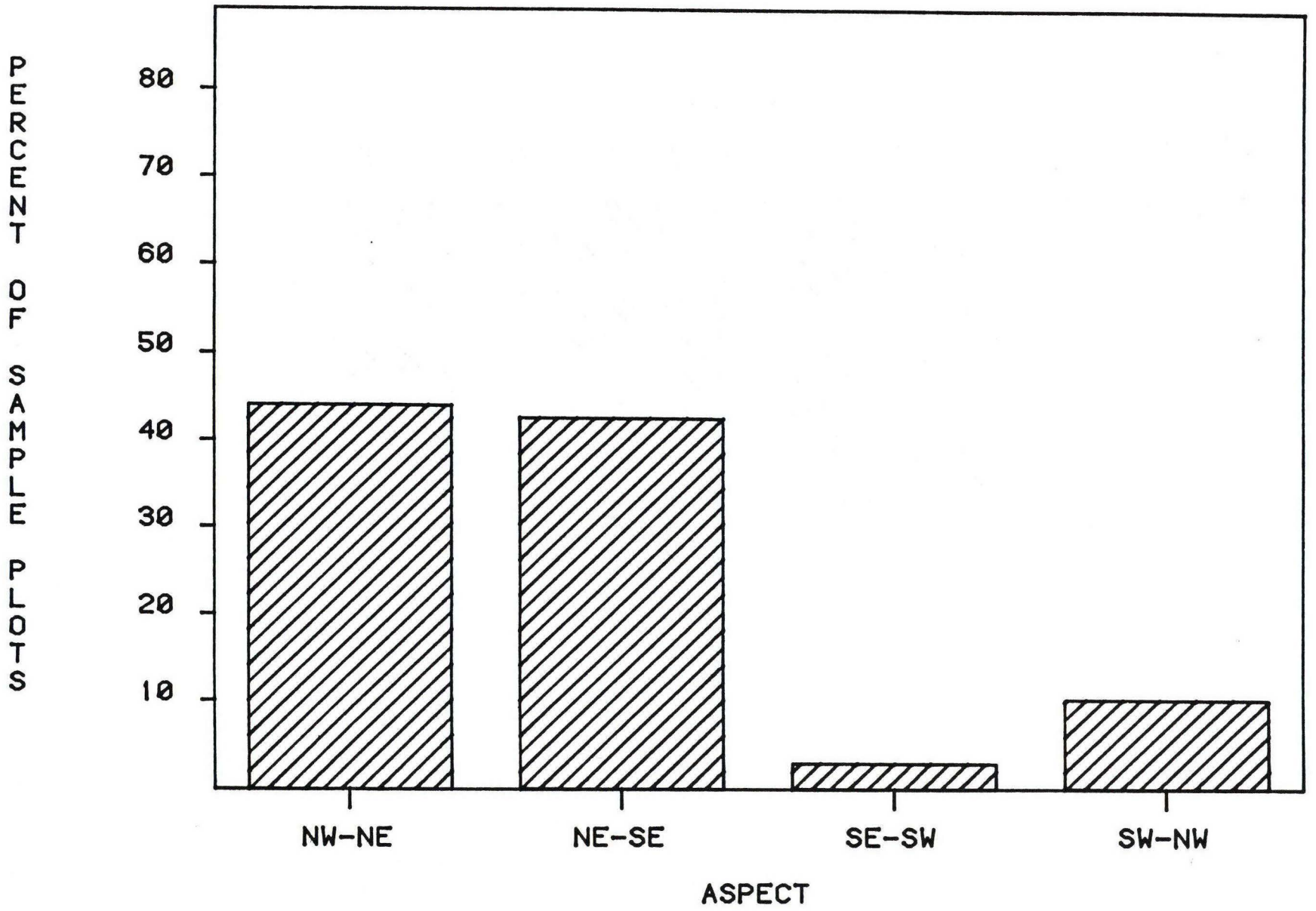

Figure 3. Aspect in nest stands.

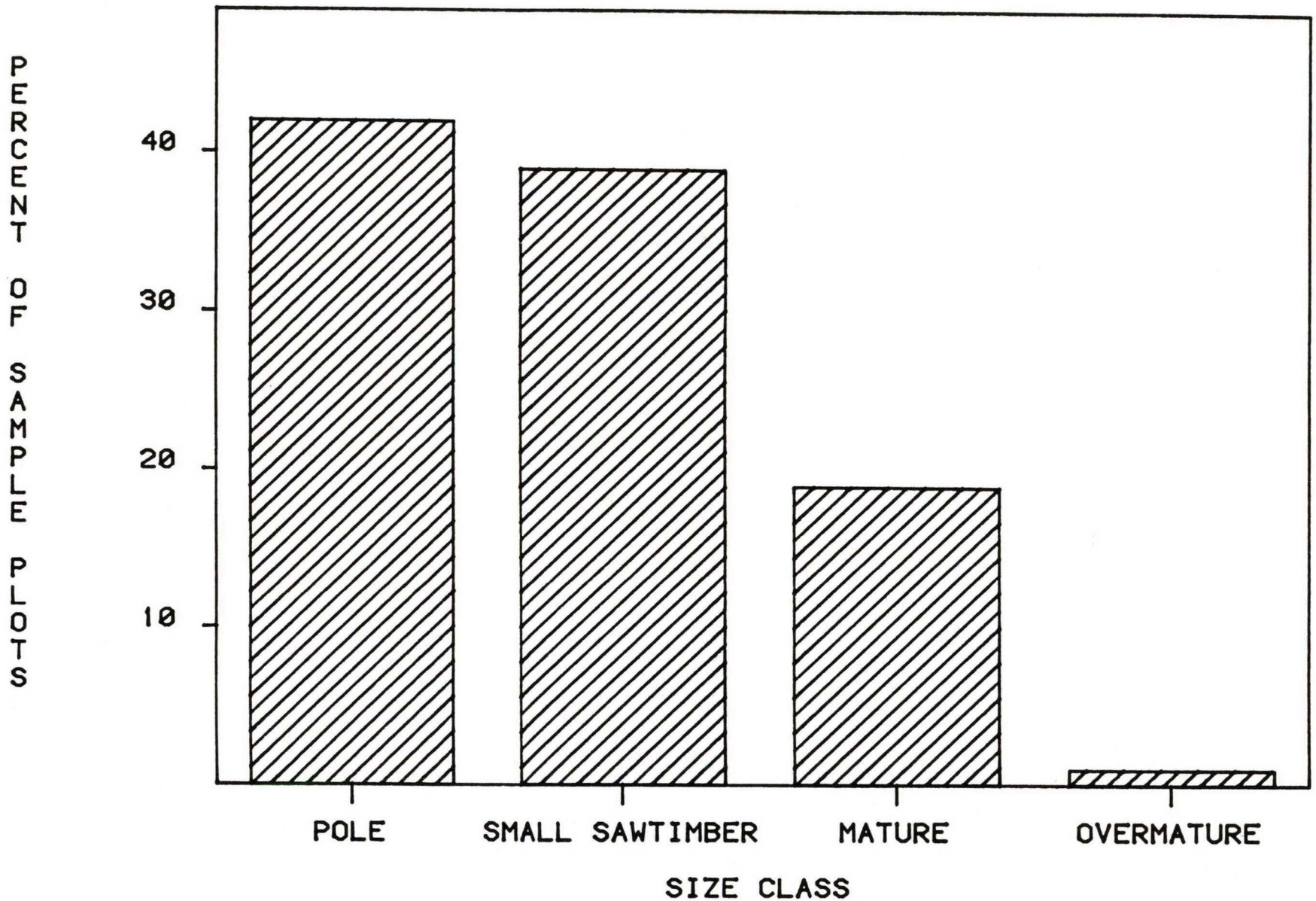

Figure 4. Size class distribution of Douglas Fir in control stands.

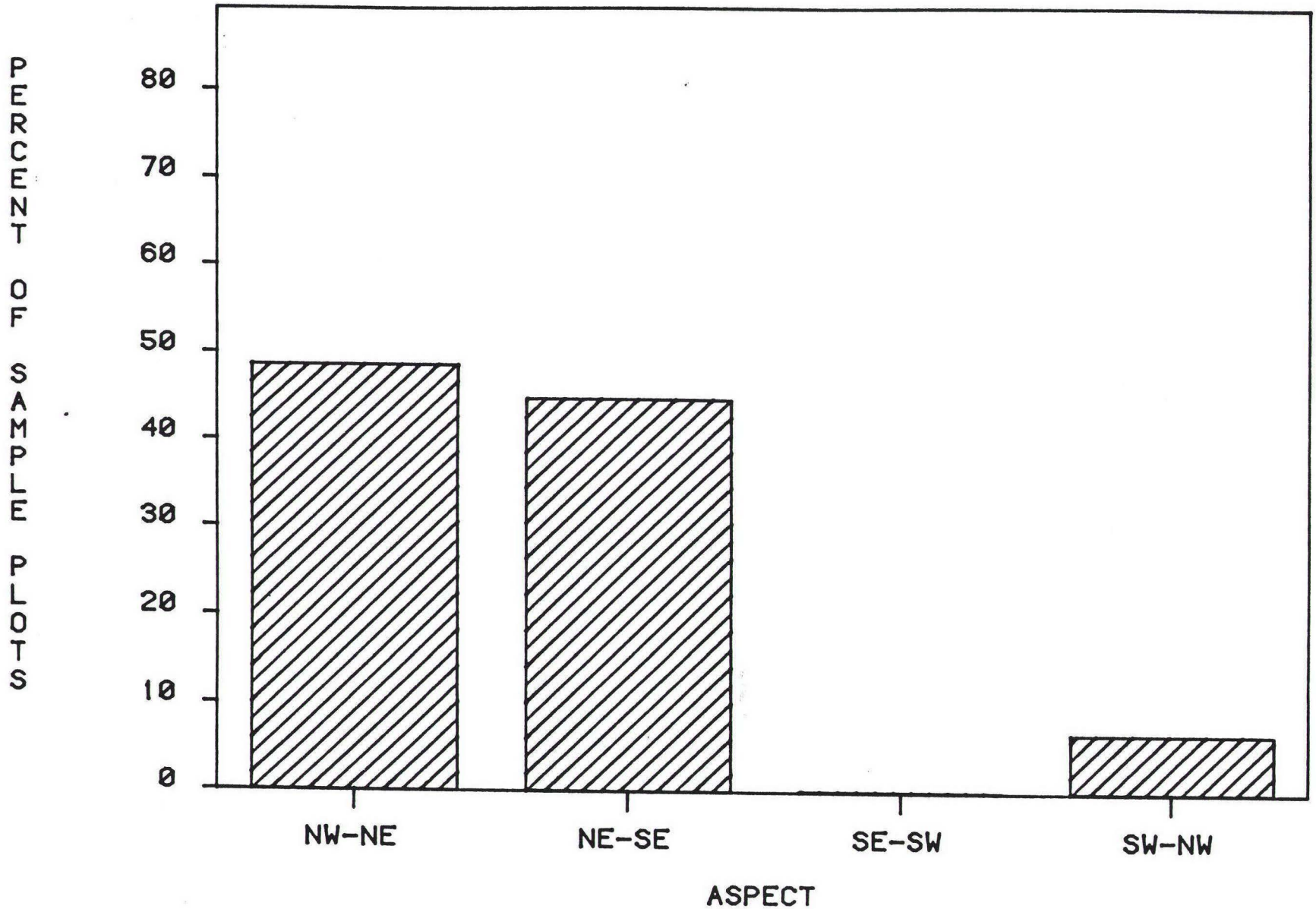

Figure 5. Aspect in control stands.

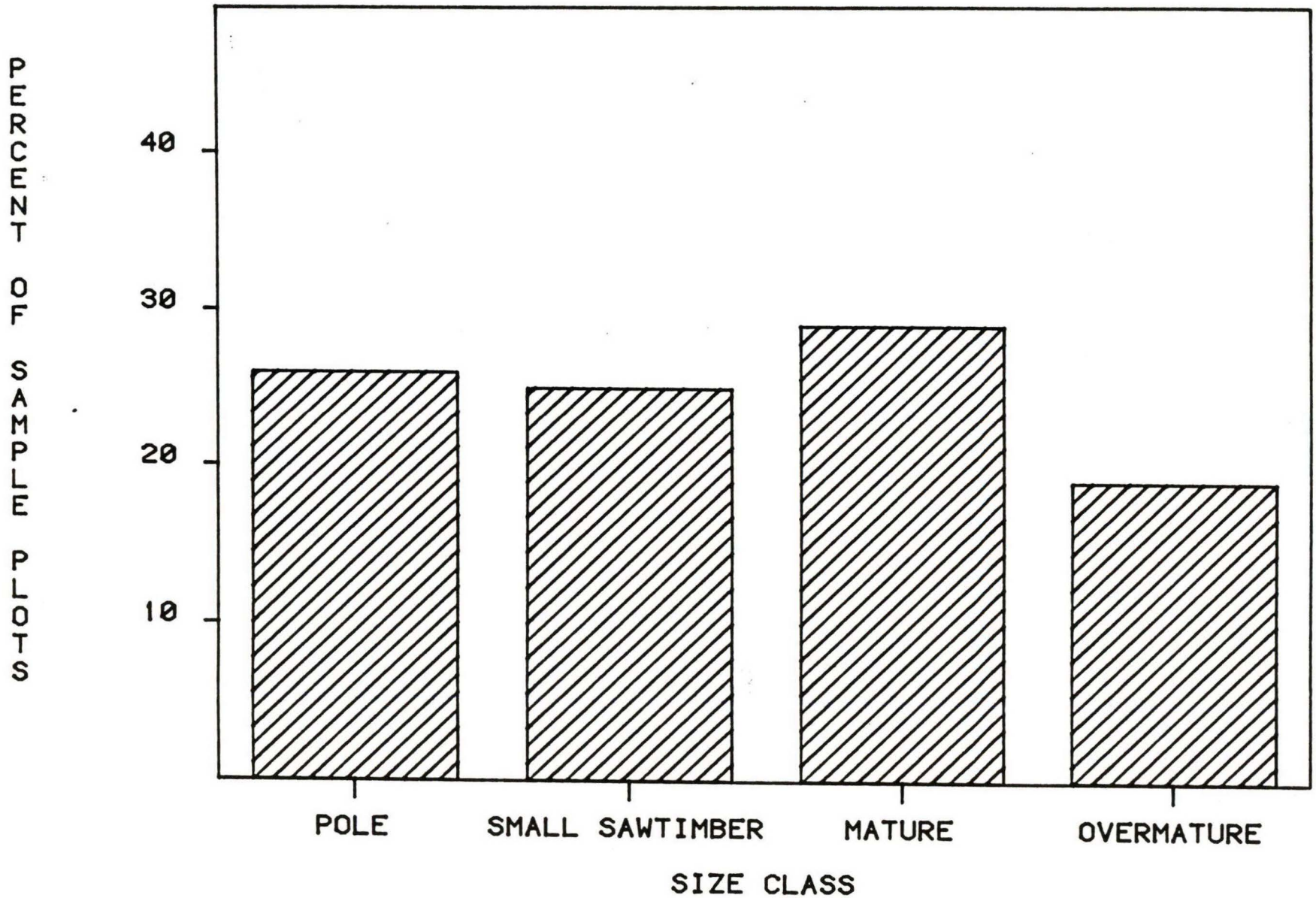

Figure 6. Size class distribution of Douglas Fir in nest sites.

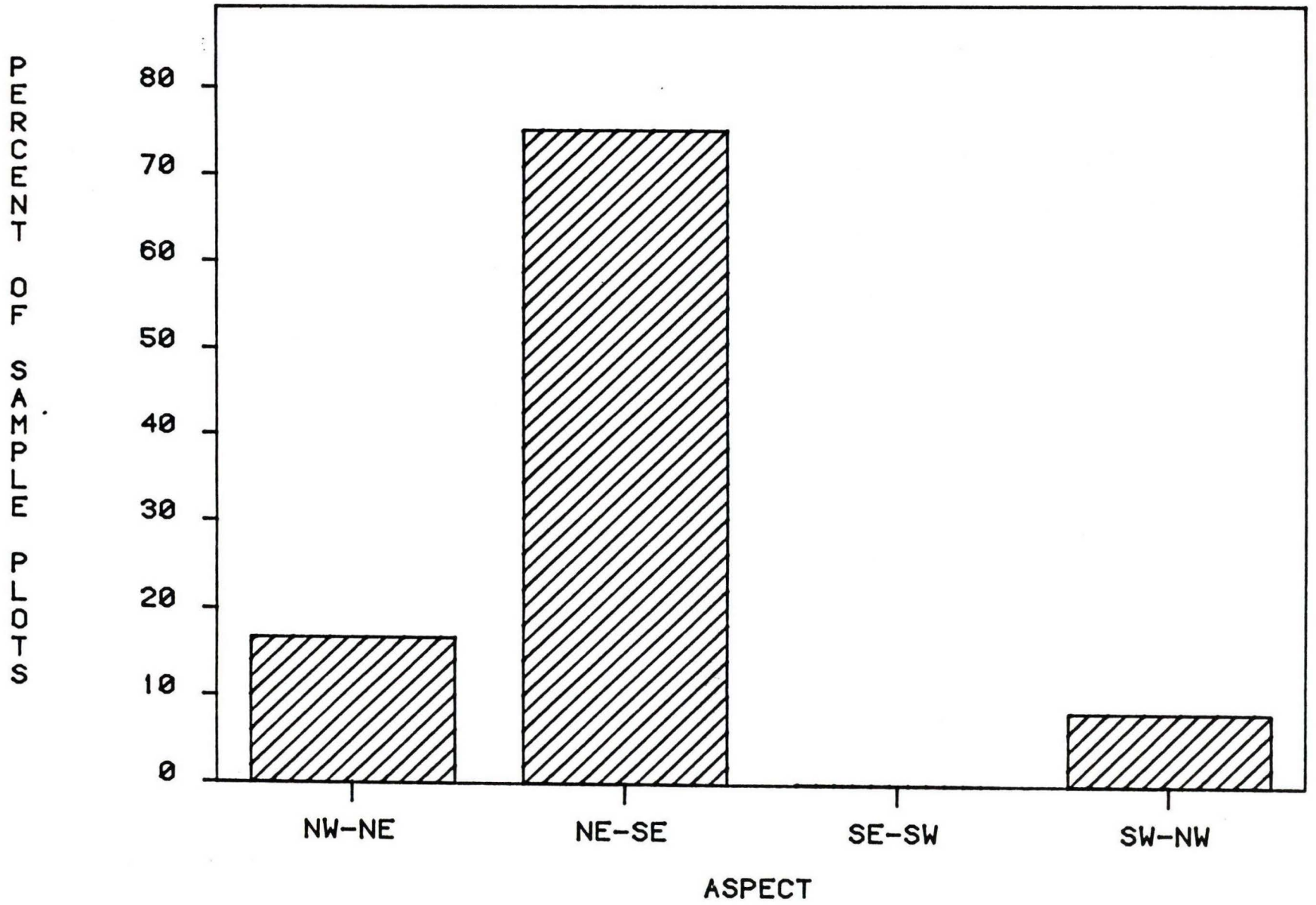

Figure 7. Aspect in nest sites.

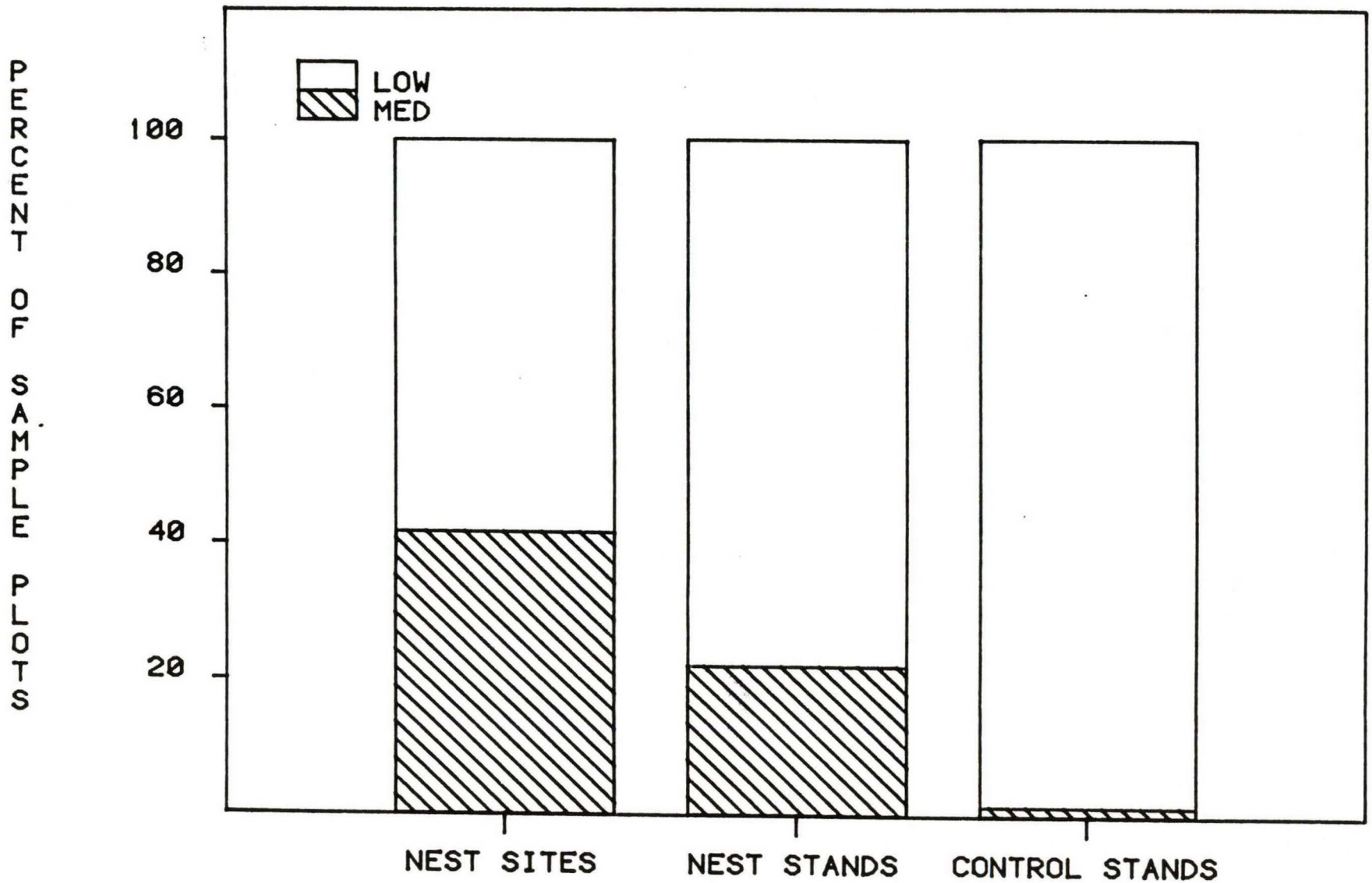

Figure 8. Decadence per habitat analysis level.

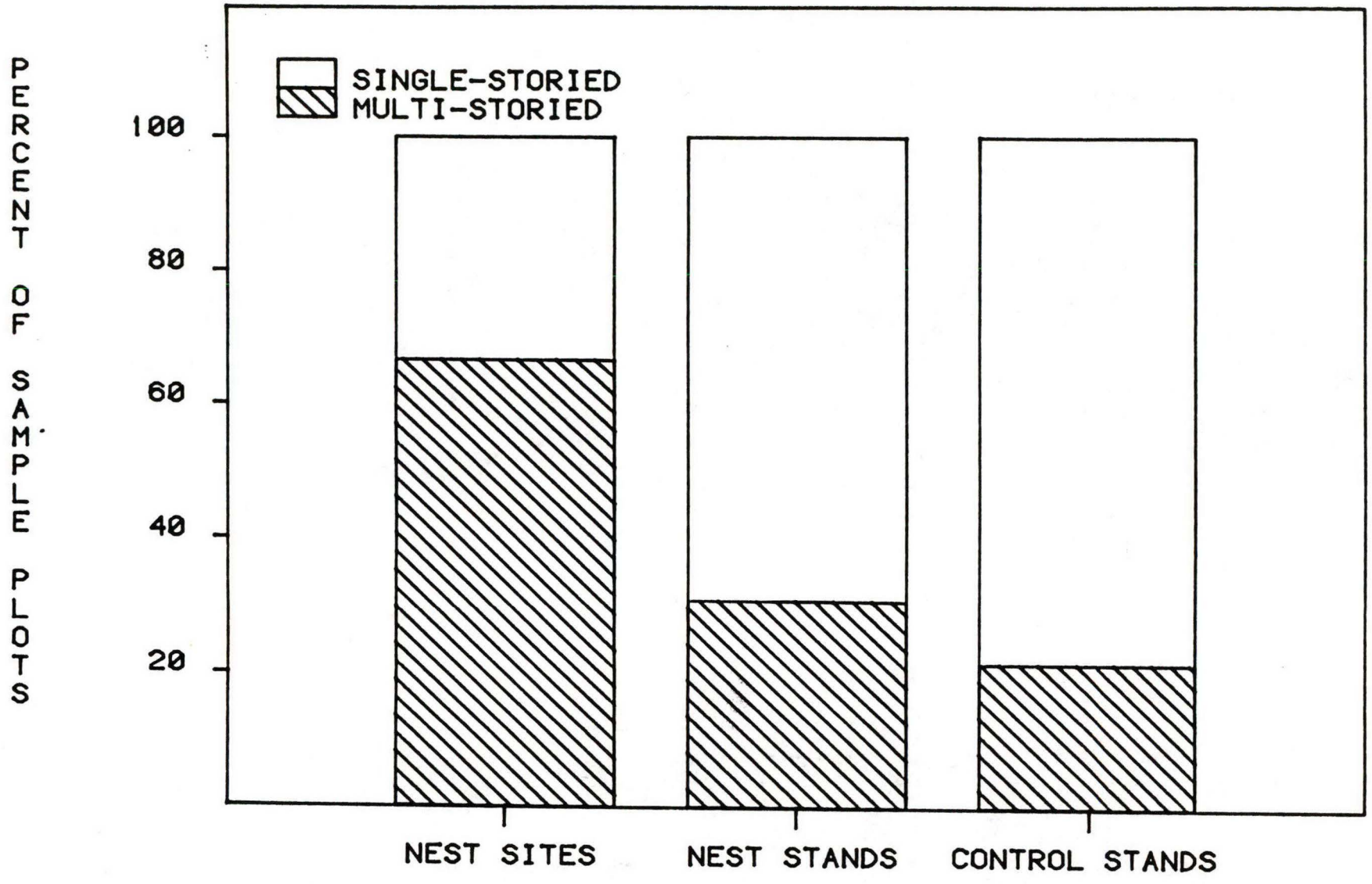

Figure 9. Number of canopy strata per habitat analysis level.

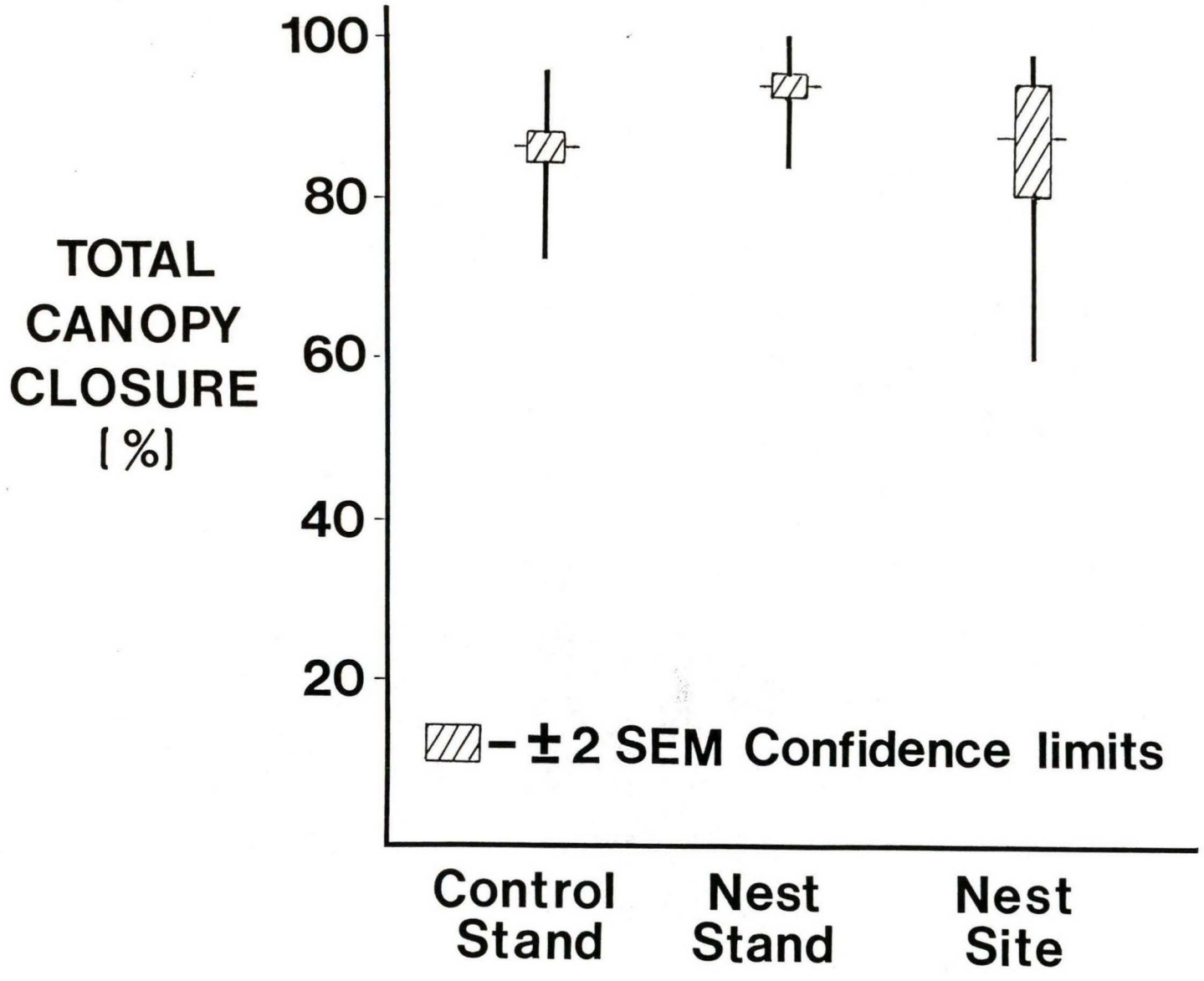

Figure 10. Comparison of canopy closure for three levels of habitat analysis.

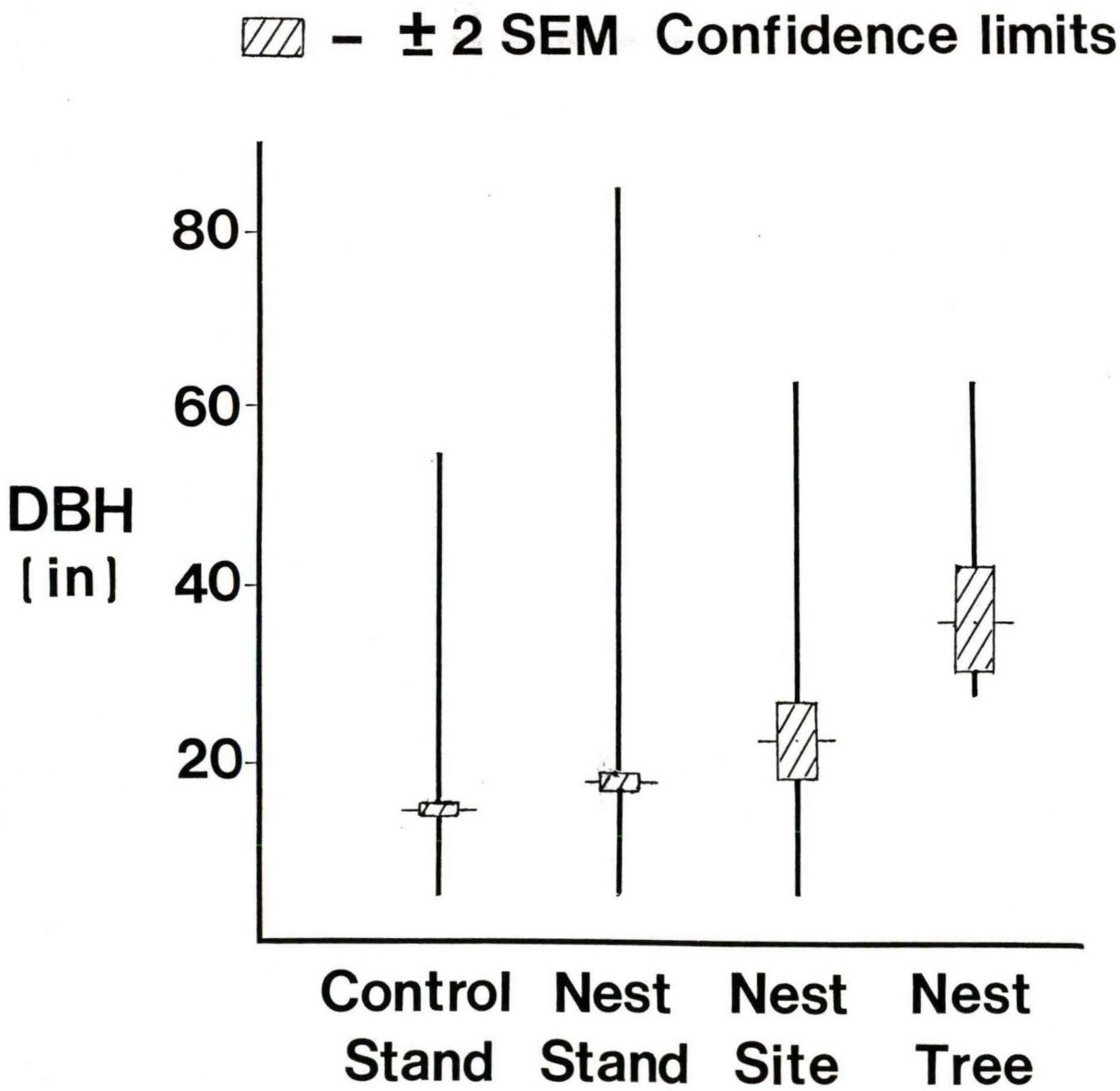

Figure 11. Comparison of diameter at breast height (DBH) for three levels of habitat analysis.

Table 1. Community patterns description for nest stands; level 2 analysis.

*Habitat type	Total acres in type Mean	Standard Error	Range	Type patch size (ac) Mean	N	Nearest patch of type (ft) Mean	Range
A) Description:							
clearcut	96	41	0-369	33	30	51	38-65
meadow	214	58	0-461	20	141	115	50-242
nonvegetated	389	150	8-2004	218	37	104	42-170
brush	548	230	6-3023	114	125	77	13-136
hardwood: 2A	669	396	6-5161	76	87	180	21-500
2B	857	633	23-8013	281	38	224	90-420
2C	257	242	0-3000	31	5	205	41-507
3A	344	92	3-979	79	66	154	8-356
3B	415	145	62-2005	132	48	139	19-372
3C	151	35	0-566	240	9	145	28-329
conifer: 2B	38	24	0-307	36	10	179	18-380
2C	737	730	0-9000	36	2	267	227-307
3A	504	137	51-1640	105	72	75	12-144
3B	869	131	439-2129	76	152	76	9-179
3C	766	548	16-7003	62	42	99	2-331
4A	661	297	92-4027	127	78	51	5-132
4B	606	120	328-1775	88	94	37	0-100
4C	18	18	0-219	110	2	148	148-148
B) Patterning:							
dispersion index	43	2	35-53				

*refer to Table 1, Appendix A.

Table 2. Community patterns description for control stands; level 2.

*Habitat type		Total acres in type Mean	Standard Error	Range	Type patch size (ac) Mean	N	Nearest patch of type (ft) Mean	Range
A) Description:								
clearcut		19	8	0-71	34	7	191	33-346
meadow		479	49	77-538	23	207	885	40-8010
nonvegetated		355	45	97-531	137	42	916	40-8007
brush		449	64	99-762	31	139	182	10-1002
hardwood:	2A	637	136	54-1076	76	99	358	6-3039
	2B	1066	210	145-1903	146	88	668	18-6010
	12C	29	9	0-65	64	5	2157	24-8035
	3A	316	49	59-473	99	65	125	23-312
	3B	408	51	133-589	45	87	117	11-304
	3C	50	10	0-80	45	10	273	116-469
conifer:	2B	25	16	0-166	34	6	245	126-364
	2C	18	13	0-128	35	5	15	15-15
	3A	905	51	346-930	76	132	223	11-1560
	3B	1421	138	482-2035	87	171	79	9-390
	3C	574	42	92-548	107	71	228	70-940
	4A	262	37	60-424	37	67	136	70-225
	4B	1028	104	270-1282	80	138	104	16-260
	4C	not represented						
B) Patterning:								
dispersion index		51	2	38-62				

*refer to Table 1, Appendix A.

Table 3. General nest stand description; level 3 analysis.

Variable		Mean/ Mode	Standard error	N	Range
overall stand:					
dominant species		DF		68	
DBH	(in)	18	0.3	1044	5-85
basal area	(ft^2/acre)	393	12	68	160-641
slope	(%)	41	2	68	4-87
aspect	(deg)	34		68	330-292
altitude	(ft)			68	1620-3560
numbers of stories		1		68	1-2
total canopy closure	(%)	94	0.4	68	84-100
CIA decadence		low		68	low-med
area	(ac)	25	6	10	4-74
number of mature trees		4	0	68	0-14
number of overmature trees	68	0-5			
stems per acre:					
total live		173	13	68	30-510
Douglas Fir		151	11	68	30-400
oak		10	2	68	0-120
madrone		8	3	68	0-100
snag		31	3	68	0-100
ground cover:					
herbaceous	(in)	156	24	168	0-833
shrub	"	96	17	68	0-515
rock	"	18	4	68	0-136
bare ground	"	5	1	68	0-48
litter	"	357	20	68	9-810
dead & down # 1	"	234	19	68	9-610
# 2	"	37	9	68	0-538
single storied plots:					
dominant species		DF		47	
DBH	(in)	17	0.4	785	5-85
canopy closure	(%)	94	0	47	87-100
tree height	(ft)	138	4	146	88-207
lower canopy height	"	84	3	146	20-127
canopy depth	"	54	2	146	26-88
percent total plots	(%)	69			
multi-storied plots:					
overstory:					
dominant species		DF		21	
DBH	(in)	36	1.2	90	21-72
canopy closure	(%)	74	4	21	23-94
tree height	(ft)	154	7	61	94-225
lower canopy height	"	79	5	61	43-132
canopy depth	"	75	4	61	46-106
percent total plots	(%)	31			
understory:					
dominant species		DF		21	
DBH	(in)	11	0.4	169	5-25
canopy closure	(%)	19	4	21	2-67
tree height	(ft)	85	8	46	17-179
lower canopy height	"	45	5	46	9-92
canopy depth	"	41	4	46	8-81

Table 4. General Control stand description; level 3 analysis.

Variable		Mean/ Mode	Standard error	N	Range
overall stand:					
dominant species		DF		74	
DBH	(in)	15	0.2	1411	5-55
basal area (ft^2/acre)		388	10	74	200-640
slope	(%)	31	2	74	1-60
aspect	(deg)	45		74	303-260
altitude	(ft)			74	2735-3890
numbers of stories		1		74	1-2
total canopy closure	(%)	86	1	74	72-96
CIA decadence		low		74	low-med
area	(ac)	27	5	10	12-62
number of mature trees		4	0	74	0-8
number of overmature trees		0	0	74	0-2
stems per acre:					
total live		203	7	74	50-340
Douglas Fir		190	1	74	50-330
oak		8	1	74	0-70
madrone		3	1	74	0-50
snag		47	4	74	0-130
ground cover:					
herbaceous	(in)	24	4	74	0-139
shrub	"	25	6	74	0-276
rock	"	12	2	74	0-109
bare ground	"	4	1	74	0-29
litter	"	421	13	74	194-661
dead & down # 1	"	357	12	74	143-553
# 2	"	58	6	74	0-273
single storied plots:					
dominant species		DF		59	
DBH	(in)	14	0.2	1173	5-47
canopy closure	(%)	87	1	59	72-96
tree height	(ft)	114	2	177	113-175
lower canopy height	"	87	1	177	64-112
canopy depth	"	57	2	177	24-79
percent total plots	(%)	80			
multi-storied plots:					
overstory:					
dominant species		DF		15	
DBH	(in)	28	0.8	78	13-55
canopy closure	(%)	60	5	15	26-82
tree height	(ft)	136	6	44	103-191
lower canopy height	"	76	4	44	48-110
canopy depth	"	60	3	44	35-81
percent total plots	(%)	20			
understory:					
dominant species		DF		15	
DBH	(in)	9	0.2	160	5-25
canopy closure	(%)	24	5	15	4-64
tree height	(ft)	77	8	45	33-140
lower canopy height	"	44	5	45	19-91
canopy depth	"	33	3	45	14-53

Table 5. Nest site description; level 4 analysis.

Variable	Mean/ Mode	Standard error	N	Range
overall stand:				
dominant species	DF		12	
DBH (in)	23	2.4	118	5-63
basal area (ft^2/acre)	392	28	12	189-520
slope (%)	42	6	12	11-80
aspect (deg)	66		12	326-258
altitude (ft)			12	1620-3395
numbers of stories	2		12	1-2
total canopy closure (%)	88	3	12	60-98
CIA decadence	low		12	low-med
area (ac)	0.1		12	
number of mature trees	5	0	12	3-9
number of overmature trees	2	0	12	0-4
stems per acre:				
total live	113	12	12	50-170
Douglas Fir	98	13	12	40-170
oak	1	1	12	0-10
madrone	8	4	12	0-40
snag	22	6	12	0-60
ground cover:				
herbaceous (in)	113	23	12	0-221
shrub "	109	35	12	0-337
rock "	25	13	12	0-136
bare ground "	8	4	12	0-48
litter "	410	45	12	117-703
dead & down # 1 "	207	33	12	54-421
# 2 "	28	9	12	0-70
single storied plots:				
dominant species	DF		4	
DBH (in)	20	3.7	35	6-37
canopy closure (%)	81	8	4	60-96
tree height (ft)	127	6	12	112-141
lower canopy height "	79	8	12	67-102
canopy depth "	48	8	12	27-61
percent total plots (%)	33			
multi-storied plots:				
overstory:				
dominant species	DF		8	
DBH (in)	39	6.5	38	25-63
canopy closure (%)	61	9	8	15-83
tree height (ft)	170	15	24	123-245
lower canopy height "	86	11	24	49-147
canopy depth "	85	9	24	55-130
percent total plots (%)	67			
understory:				
dominant species	DF		8	
DBH (in)	11	1.8	45	5-23
canopy closure (%)	30	10	8	5-83
tree height (ft)	82	11	23	28-132
lower canopy height "	46	8	23	11-80
canopy depth "	37	5	23	16-56

Table 6. Additional nest site data; level 4 analysis continued.

Variable	Mean/ Mode	Standard error	N	Range
plucking perches:				
number	2	0	12	1-3
slope relationship	up		30	down-up
distance (ft)	40	7	30	4-200
relationship to nest	above		30	below-above
height	59	4	30	2-110
canopy openings:				
number	1	0	11	1-2
slope relationship	down		14	down-up
size (ft^2)	1212	398	14	80-4800
distance (ft)	edge of foliage		14	0
cause	downed tree		14	

Table 7. General nest and nest tree description; level 5 analysis.

Variable	Mean/ Mode	Standard error	N	Range
Nest:				
height (ft)	69	5	12	31-92
size (ft^3)	2.4	0.2	12	1.5-4.0
material	sticks		12	
condition	good		12	
distance to trunk	0		12	poor-excellent
aspect (deg)	25		12	272-200
slope side	down		12	down-up
canopy closure (%)	86	2	12	75-95
relationship to canopy	below		12	below-lower1/4
rel. to stand canopy	lower 1/4		12	below-lower1/4
support:				
number	3	0	12	1-5
condition	dead		39	dead, alive
diameter (in)	4	1	39	2-18
length (ft)	13	2	39	2-40
Nest tree:				
species	DF		12	DF, madrone
DBH (in)	36	3	12	27.7-63.0
nearest tree (ft)	9	1	12	4-22
tree height (ft)	141	9	12	80-181
lower canopy height (ft)	73	6	12	32-101
canopy depth (ft)	68	5	12	42-92
canopy layer	overstory		12	overstory
decadence	med		12	low-med
position on slope	lower 1/3		12	1 1/3-u 1/3
altitude (ft)			12	1620-3395

Table 8. Proximity analysis results; level 5 analysis.

Variable	Mean/ Mode	Standard error	N	Range
Nests:				
Water sources:				
Closest:				
distance (ft)	502	213	13	0-2310
permance	intermittent		13	perm., inter.
order	1		13	1-3
Overall:				
number	3	1	13	2-4
distance (ft)	1163	179	38	0-4125
permance	intermittent		38	perm., inter.
order	1		38	1-5
Disturbances:				
Closest:				
distance (ft)	916	321	13	100-4375
type	road		13	trail, road
usage	light		13	heavy, light
Overall:				
number	3	0	13	2-5
distance (ft)	2101	35	43	100-6600
type	road		43	trail, residence
usage	light		43	light-high
Nearest nest:				
distance (mi)	4	1.2	9	1.5-13.8
Controls:				
Water sources:				
Closest:				
distance (ft)	971	386	10	0-3750
permance	intermittent		10	perm., inter.
order	1		10	1-9
Overall:				
number	3	0	10	1-5
distance (ft)	1466	225	34	0-5940
permance	intermittent		34	perm., inter.
order	1		34	1-9
Disturbances:				
Closest:				
distance (ft)	979	362	10	0-3960
type	road		10	road, residence
usage	light		10	heavy-light
Overall:				
number	3	0	10	1-4
distance (ft)	2649	495	25	0-9603
type	road		25	trail-residence
usage	light		25	light-high
Nearest nest:				
distance (mi)	6	1.2	10	0.2-13.4

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APPENDIX A

Techniques, Terminologies and Methodologies

Table 1. Habitat classification system developed for community patterns (level 2) analysis.

Base Type	Type Designation	Description		
Non-forested	Clearcut	Trees and brush absent, sparse grass cover		
	Meadow	Over 30% cover by annual or perennial grasses, trees and brush absent		
	Non-vegetated	Rock, water courses (including bed), bare ground		
	Brush	Presence of low-lying woody vegetation (shrubs) including hardwood and conifers under 5.0 inches in diameter		
			[1]Size Class	[2,3]Canopy Closure
Hardwood	H2A		2	A
	H2B		2	B
	H2C		2	C
	H3A		3	A
	H3B		3	B
	H3C		3	C
Conifer	C2B		2	B
	C2C		2	C
	C3A		3	A
	C3B		3	B
	C3C		3	C
	C4A		4	A
	C4B		4	B
	C4C		4	C

	Variable		Criteria	
1/	Size Class:	2	DBH range (in):	5.0-10.9
		3		11.0-20.9
		4		21.0-36 +
2/	Canopy Closure:	A		0-40%
		B		40-70%
		C		70% +

3/ Total canopy closure including all strata of all hardwood and coniferous elements.

Table 2. Level 3 analysis variables and sampling methodologies.

Variable	Technique: Terminology: Equations
A. Field Measurements:	
Species	Visual
DBH	DBH tape, to nearest 0.1 inch
Canopy layer	Visual: upper, lower
*Stems per acre	10 X number or live trees in 0.1 acre plot
Basal area	Relaskop, basal area factor (BAF) = 40
Slope	Relaskop, to nearest 1%
Altitude	Altimeter, to nearest 5 ft
Aspect	Compass, to nearest degree
[1]Decadence	Visual estimate: low, medium, high
*Ground cover	900 inch line transect, by inch: herbaceous, shrub, rock, bare ground, litter, dead and down #1 & #2
Dominant form	Visual estimate: forb, shrub, grass
Total closure	Spherical densiometer, average of four readings, to nearest 1%
*# Strata	Visual estimate
Strata Information:	
Dominant species	Visual estimate
% closure	Visual estimate, to nearest 5%
Tree height:	
Height	Relaskop, to nearest foot
Distance	Pacing, to nearest foot
Lower height	Relaskop, to nearest foot

* Refer to Table 4 for definitions
1/ Refer to Table 3; Characteristics of the deterioration.

Table 2. Level 3 analysis variables and sampling methodologies. (Cont.)

Variable	Technique: Terminology: Equations
B. Calculated Variables:	
Total closure	Total closure = 100 - 0.96 (average reading)
Canopy closure per strata	% closure = total closure x estimiate of percent of total closure attributable to strata
Tree height	Tree height = average height reading x distance/100
Lower canopy height	Lower canopy height = average lower height x distance/100
Canopy depth	Canopy depth = tree height - lower canopy height
Area	Dot grid on 1:15840 natural color aerial photographs

Table 3. [1]Decadence Index for Douglas-fir.

Decadence Level = 1 - low (Trees dead less than 1 year)

Foliage	10 percent or more present
Twigs	75 percent or more present
Limbs	Intact
Top	Intact
Bark	Intact
Sapwood	Green to stained
Fungi	Fresh Polyporus volvatus [2]

Decadence Level = 2 - medium (Trees dead 1 to 5 years)

Foliage	Less than 10 percent present
Twigs	10 to 75 percent present
Limbs	Some falling on small trees
Top	Some breakage in top 1/4 of tree around 4th year
Bark	Some sloughing on small trees
Sapwood	Some sapwood deterioration
Fungi	Fomes pinicola on small trees [3]

Decadence Level = 3 - high (Trees dead more than 5 years)

Foliage	Absent
Twigs	Less than 10 percent present
Limbs	Falling
Top	Top 1/2 broken on about 50 percent of trees
Bark	Sloughing
Sapwood	Considerable sap rot
Fungi	F. pinicola and other conks common

1/ Appendix J. Characteristics of Tree Deterioration (USFS 1980).

2/ Small, round, white sporophores on bole of tree (usually less than 1 1/2-inch diameter).

3/ F. pinicola conks are small and yellowish in color for first three years, and first appear in bark crevices. From 4th year on, they develop reddish margins and become large and bracket-shaped. Source: Field Instructions For Integrated Forest Survey: R5, R6, and PNW, 1972.

Table 4. Criteria for Level 3 variables.

Variable	Criteria
# Strata	[1] "...two storied stands are those stands which have two distinct height classes of recognizable difference called the understory and the overstory. The overstory and understory must be at least two stand size classes removed to be recognized as two-storied,..."

Stand Size	Class	DBH Range (in)
Seedling	(1)	0 - 4.9
Pole timber	(2)	5.0 - 10.9
Small sawtimber	(3)	11.0 - 20.9
Mature	(4)	21.0 - 36 with low decadence
Over-mature	(5)	36.0+ with medium to high decadence

Stems/acre	Tree: DBH greater than 4.9 in (size class 2+)
Ground cover	Herbaceous: live plant material
	Shrub: live woody plant with DBH less than 5.0 in
	Rock
	Bare ground
	Litter: plant material not attached to a living plant; leaves, bark, needles
	Dead and Down - 1: woody material having diameter from 0.5 - 4.9 inches and not attached to living plants
	Dead and Down - 2: woody material having diameter 5.0 inches or greater and not attached to living plants

1/ Six Rivers National Forest Timber Classification System

Table 5. Additional nest site (Level 4) variables and sampling methodologies.

Variable	Technique: Terminology: Equations
A. Field Measurements	
Plucking Perches:	
Species	Visual
Slope Relationship	Visual: up, down or sideslope
Direction	Compass, to nearest degree
Distance	Pacing, to nearest foot
Height	Relaskop, to nearest foot
Elevation	Altimeter, to nearest 5 feet
Canopy Openings:	
Slope relationship	Visual: up, down or sideslope
Size	Pacing, to nearest foot
Direction	Compass, to nearest degree
Distance from tree	Pacing, to nearest foot
Cause	Visual: snag, downed tree, natural opening
B. Calculated Variables	
Opening size	Size = length x width or Size = $2\pi r^2$
Plucking perch height	Height = height x distance/100
Relationship of plucking perch to nest	Above, below, level based on difference = (nest height + elevation) - (plucking perch height + elevation) Below: difference greater than 0 Level: difference = 0 Above: difference less than 0

Table 6. Sampling techniques and terminology associated with nest and nest tree (Level 5) variables. (Cont.)

Variable	Technique: Terminology: Equations
[2]Support:	
Diameter	Visual estimate using photographic aids, to nearest inch
Dead or alive	Visual estimate: dead, alive
Length	Visual estimate using photographic aids, to nearest foot
Proximity Analysis:	
*Water sources:	
Distance	Pacing, 1:15840 aerial photographs or 1:1000 maps, to nearest foot
Permanence	Visual, field observations: intermittent, permanent
Class	Visual, field observations, hydrological maps: creek, stream, river, lake
*Disturbances:	
Distance	Pacing, 1:15840 aerial photographs or 1:1000 maps, to nearest foot
Type	Visual, field observations: road, trail, campground, dwelling
Level of use	Visual, field observations: light, medium, heavy
B. Calculated Variables	
*Canopy layer of nest tree	DBH tape: overstory, understory
Nest tree height	Height = height x distance/100
Nest tree lower canopy height	Lower canopy height = lower height x distance/100
Nest tree canopy depth	Canopy depth = tree height - lower canopy height

Table 6. Sampling techniques and terminology associated with nest and nest tree (Level 5) variables. (Cont.)

Variable	Technique: Terminology: Equations
Relation of nest to nest tree canopy	Visual and calculated: relationship = nest tree lower canopy height - nest height lower 1/4 of canopy - relationship less than 0 level - relationship = 0 below - relationship greater than 0
Relationship of nest to site canopy	Relationship = nest site lower canopy height - nest height within - relationship less than 0 level - relationship = 0 below - relationship greater than 0

* Refer to Table 7

1/ Refer to Table 3 this Appendix

2/ Support for the nest will be determined from and illustrated by telephoto photographs taken from the side and beneath the nest, when possible, in addition to data recorded in the field.

Table 7. Criteria for Level 5 variables.

Variable	Criteria
Nest Condition	Excellent - shape and form retained, material organized; required little or no rebuilding. Good - shape, form deteriorated or material disorganized; required some rebuilding i.e., retained structural integrity. Example: side wall broken down. Poor - damage high, structural integrity lost; required major rebuilding. Example: half nest lost.
[1]Canopy layer of nest tree	Classified according to DBH and the structure of the canopy.
Water source class	Based on [2]order and permanence: Stream - 1-2, intermittent Creek - 3-5, intermittent or permanent River - 4+, permanent
Disturbance use level	Dwelling: "season" restrict to March 1 - August 15. Light - use by 1 person, 1 vehicle or off-season use Medium - use by 2-3 persons, 1 vehicle Heavy - use by 3+ persons and/or 1+ vehicles Trail: Light - 1-4 people, animals, no vehicles, or off-season use Medium - 5-10 people, 1-2 vehicles Heavy - 10+ people, 2+ vehicles Campground: Light - unimproved, 1-2 groups of 1-3 persons or off-season use Medium - 3-5 groups of 1-3 persons or 1-2 groups of 3+ persons

Table 7. Criteria for Level 5 variables.

Variable	Criteria
	Heavy - 5+ groups of 1-3 persons, 2+ groups of 3+ persons or RV usage
Road:	
	Light - daily use by 1-2 passenger cars, no heavy vehicles or off-season use
	Medium - daily use by 3-10 passenger cars or 1-2 heavy vehicles
	Heavy - daily use by 10+ passenger cars or 2+ heavy vehicles

1/ Refer to Table 4 this Appendix
2/ (Ruhe 1975)

APPENDIX B

Field Forms

LEVEL II & III

Site: ______________________ Legal: ______________________ Date: ______________

Samplers: ______________________ Weather: Sun: __________ Wind: __________

P#	Sp	Upper canopy	DBH	Lower canopy	Stems /acre	BA	n	X	ΣX	X^2	ΣX^2	SEM	SEM/ $\overline{X}$

PLOT #	1	2	3	4	5	6	7	8
Slope XS:								
altitude								
aspect								
decadence								
ground cover:								
dom. species								
herb/shrub								
rock/ground								
litter								
dd1 / dd2								
dots covered	X .96=	X .96=	X .96=	X .96=	X .96=	X .96=	X .96=	X .96=
total closure								
# strata								
dom. species								
% closure								
ht: distance								
tree ht.								
lower can.								
anopy XS:								
dom. species								
ht: distance								
tree ht.								
lower can.								
otes:								

GROUND COVER LINE TRANSECT

Site: _____

Plot#: _____

Ft.	vegetation herbaceous	vegetation shrub	rock	bare ground	litter	dead & down 1	dead & down 2
2							
4							
6							
8							
10							
12							
14							
16							
18							
20							
22							
24							
26							
28							
30							
32							
34							
36							
38							
40							
42							
44							
46							
48							
50							
52							
54							
56							
58							
60							
62							
64							
66							
68							
70							
72							
74							
75							

LEVEL III & IV

Site _____ Date _____ Samplers _____

Level III				
Nest tree:				
status				
use				
species				
dbh				
nearest tree				
tree ht.				
lower can.				
decadence				
pos. on slope				
canopy layer				
Plucking perches:				
species				
slope rel.				
direction				
distance				
height				
Openings:				
slope rel.				
size				
direction				
distance				
cause				
Level IV				
Nest:				
ht.				
dimensions				
material				
condition				
dist. to trunk				
aspect				
slope side				
% closure				
rel. stand canopy				
rel. to canopy				
support: dia.				
d/a				
length				
lower view				

APPENDIX C

Individual Nest Stand and Control Stand Summaries

Table 1. Nest stand description for Butte Creek; level 3 analysis.

Variable	Mean/ Mode	Standard error	N	Range
overall stand:				
dominant species	DF		9	
DBH (in)	23	1.4	65	5-72
basal area (ft^2/acre)	329	36	9	160-480
slope (%)	69	5	9	45-87
aspect (deg)	16		9	340-53
altitude (ft)			9	2720-2990
numbers of stories	1		9	1-2
total canopy closure (%)	92	1	9	87-96
CIA decadence	low		9	low-med
area (ac)	74			
number of mature trees	4	1	9	0-6
number of overmature trees	2	1	9	0-5
stems per acre:				
total live	94	9	9	30-120
Douglas Fir	72	9	9	0-30
oak	11	6	9	0-40
madrone	3	3	9	0-30
snag	10	5	9	0-50
ground cover:				
herbaceous (in)	485	98	9	45-855
shrub "	170	78	9	0-515
rock "	27	15	9	0-135
bare ground "	0	0	9	0-2
litter "	163	74	9	9-630
dead & down # 1 "	47	8	9	9-90
# 2 "	8	5	9	0-45
single storied plots:				
dominant species	DF		5	
DBH (in)	20	2.3	30	7-57
canopy closure (%)	92	1	5	87-95
tree height (ft)	137	18	8	93-194
lower canopy height "	72	15	8	20-106
canopy depth "	65	8	8	47-88
percent total plots (%)	56			
multi-storied plots:				
overstory:				
dominant species	DF		4	
DBH (in)	39	2.8	18	25-72
canopy closure (%)	84	1	4	80-86
tree height (ft)	165	23	10	118-225
lower canopy height "	97	16	10	56-132
canopy depth "	68	10	10	46-92
percent total plots (%)	44			
understory:				
dominant species	DF		4	
DBH (in)	12	1.6	17	5-23
canopy closure (%)	8	1	4	4-10
tree height (ft)	62	21	5	34-102
lower canopy height "	35	16	5	14-66
canopy depth "	27	5	5	20-36

Table 2. Nest stand description for East Creek; level 3 analysis.

Variable		Mean/ Mode	Standard error	N	Range
overall stand:					
dominant species		DF		8	
DBH	(in)	17	0.3	209	5-45
basal area (ft^2/acre)		466	45	8	320-641
slope	(%)	26	3	8	11-36
aspect	(deg)	31		8	330-66
altitude	(ft)			8	3250-3560
numbers of stories		1		8	1-2
total canopy closure	(%)	93	1	8	84-96
CIA decadence		low		8	low-med
area	(ac)	16			
number of mature trees		7	2	8	1-14
number of overmature trees		1	0	8	0-3
stems per acre:					
total live		349	45	8	200-510
Douglas Fir		269	31	8	180-360
oak		19	15	8	0-120
madrone		34	16	8	1-100
snag		56	6	8	30-80
ground cover:					
herbaceous	(in)	117	31	8	0-270
shrub	"	78	54	8	0-454
rock	"	8	2	8	0-16
bare ground	"	7	3	8	0-27
litter	"	365	33	8	223-479
dead & down # 1	"	293	40	8	24-389
# 2	"	32	16	8	0-131
single storied plots:					
dominant species		DF		6	
DBH	(in)	17	0.6	162	6-45
canopy closure	(%)	94	1	6	93-96
tree height	(ft)	109	7	18	88-135
lower canopy height	"	59	5	18	44-77
canopy depth	"	49	3	18	39-64
percent total plots	(%)	75			
multi-storied plots:					
overstory:					
dominant species		DF		2	
DBH	(in)	29	1.8	15	21-45
canopy closure	(%)	73	7	2	66-80
tree height	(ft)	95	0	6	94-95
lower canopy height	"	45	2	6	43-46
canopy depth	"	50	2	6	49-52
percent total plots	(%)	25			
understory:					
dominant species		DF		2	
DBH	(in)	10	0.6	32	5-18
canopy closure	(%)	15	3	2	12-18
tree height	(ft)	28	12	3	17-40
lower canopy height	"	14	6	3	9-20
canopy depth	"	14	6	3	8-20

Table 3. Nest stand description for East Fork Willow Creek; level 3 analysis.

Variable	Mean/ Mode	Standard error	N	Range
overall stand:				
dominant species	DF		6	
DBH (in)	35	2.3	38	19-85
basal area (ft^2/acre)	400	37	6	320-560
slope (%)	64	5	6	40-75
aspect (deg)	356		6	333-22
altitude (ft)			6	2640-3150
numbers of stories	1		6	1-2
total canopy closure (%)	94	2	6	90-98
CIA decadence	low		6	low-med
area (ac)	20			
number of mature trees	5	1	6	3-8
number of overmature trees	3	1	6	1-4
stems per acre:				
total live	65	8	6	40-90
Douglas Fir	63	7	6	40-80
oak	0		6	0
madrone	2	2	6	0-10
snag	15	7	6	0-40
ground cover:				
herbaceous (in)	28	9	6	0-57
shrub "	277	57	6	103-507
rock "	43	6	6	28-64
bare ground "	9	4	6	0-27
litter "	301	36	6	219-447
dead & down # 1 "	227	29	6	121-310
# 2 "	15	8	6	0-52
single storied plots:				
dominant species	DF		5	
DBH (in)	37	2.6	32	16-85
canopy closure (%)	93	2	5	90-98
tree height (ft)	178	12	15	145-207
lower canopy height "	103	8	15	88-127
canopy depth "	75	7	15	58-87
percent total plots (%)	82			
multi-storied plots:				
overstory:				
dominant species	DF		1	
DBH (in)	40	6.2	3	28-47
canopy closure (%)	88		1	
tree height (ft)	171	2	3	168-175
lower canopy height "	89	19	3	51-114
canopy depth "	82	22	3	54-124
percent total plots (%)	17			
understory:				
dominant species	DF		1	
DBH (in)	20	0.5	3	19-21
canopy closure (%)	10		1	
tree height (ft)				
lower canopy height "				
canopy depth "				

Table 4. Nest stand description for Kekawaka Creek; level 3 analysis.

Variable		Mean/ Mode	Standard error	N	Range
overall stand:					
dominant species		DF		5	
DBH	(in)	20	1.1	49	6-58
basal area (ft^2/acre)		344	16	5	320-400
slope	(%)	49	5	5	37-64
aspect	(deg)	12		5	342-45
altitude	(ft)			5	2820-2980
numbers of stories		1		5	1-2
total canopy closure	(%)	95	1	5	90-96
CIA decadence		low		5	low-med
area	(ac)	4			
number of mature trees		3	1	5	0-6
number of overmature trees		1	1	5	0-5
stems per acre:					
total live		140	18	5	100-200
Douglas Fir		98	10	5	70-120
oak		12	7	5	0-40
madrone		28	15	5	0-80
snag		14	7	5	0-30
ground cover:					
herbaceous	(in)	149	39	5	85-301
shrub	"	183	75	5	56-462
rock	"	10	6	5	0-26
bare ground	"	6	3	5	0-13
litter	"	354	66	5	220-522
dead & down # 1	"	187	41	5	93-333
# 2	"	12	7	5	0-36
single storied plots:					
dominant species		DF		3	
DBH	(in)	16	1.4	30	5-31
canopy closure	(%)	96	0	3	95-96
tree height	(ft)	96	4	9	92-103
lower canopy height	"	44	2	9	39-47
canopy depth	"	52	3	9	46-56
percent total plots	(%)	60			
multi-storied plots:					
overstory:					
dominant species		DF		2	
DBH	(in)	40	3.3	10	24-58
canopy closure	(%)	82	9	2	72-91
tree height	(ft)	152	9	6	144-160
lower canopy height	"	83	13	6	69-96
canopy depth	"	69	5	6	64-74
percent total plots	(%)	40			
understory:					
dominant species		DF		2	
DBH	(in)	14	2.0	9	6-23
canopy closure	(%)	11	6	2	5-18
tree height	(ft)	107	31	5	76-138
lower canopy height	"	53	21	5	33-74
canopy depth	"	54	10	5	45-64

Table 5. Nest stand description for Nelson Flat #1; level 3 analysis.

Variable	Mean/ Mode	Standard error	N	Range
overall stand:				
dominant species	DF		10	
DBH (in)	19	0.7	103	5-62
basal area (ft^2/acre)	380	36	10	160-520
slope (%)	42	6	10	7-58
aspect (deg)	60		10	25-92
altitude (ft)			10	2590-2980
numbers of stories	2		10	1-2
total canopy closure (%)	95	1	10	89-100
CIA decadence	med		10	low-med
area (ac)	29			
number of mature trees	4	0	10	2-6
number of overmature trees	2	0	10	0-2
stems per acre:				
total live	111	12	10	50-180
Douglas Fir	103	12	10	50-180
oak	2	2	10	0-20
madrone	1	1	10	0-10
snag	18	7	10	0-60
ground cover:				
herbaceous (in)	296	36	10	148-461
shrub "	73	26	10	0-252
rock "	38	17	10	2-136
bare ground "	6	5	10	0-48
litter "	337	25	10	238-511
dead & down # 1 "	125	21	10	34-242
# 2 "	25	7	10	0-77
single storied plots:				
dominant species				
DBH (in)				
canopy closure (%)				
tree height (ft)				
lower canopy height "				
canopy depth "				
percent total plots (%)				
multi-storied plots:				
overstory:				
dominant species	DF		10	
DBH (in)	38	2.0	31	22-62
canopy closure (%)	73	7	10	23-94
tree height (ft)	164	7	30	118-199
lower canopy height "	78	5	30	60-110
canopy depth "	86	5	30	58-106
percent total plots (%)	100			
understory:				
dominant species	DF		10	
DBH (in)	11	0.6	72	5-25
canopy closure (%)	22	6	10	5-67
tree height (ft)	96	7	30	52-139
lower canopy height "	49	3	30	24-58
canopy depth "	47	5	30	28-81

Table 6. Nest stand description for Nelson Flat #2; level 3 analysis.

Variable		Mean/ Mode	Standard error	N	Range
overall stand:					
dominant species		DF		5	
DBH	(in)	16	0.9	86	6-48
basal area (ft^2/acre)		408	39	5	280-520
slope	(%)	24	5	5	14-35
aspect	(deg)	39		5	358-102
altitude	(ft)			5	2880-3155
numbers of stories		1		5	1
total canopy closure	(%)	99	1	5	97-100
CIA decadence		low		5	low
area	(ac)	16			
number of mature trees		3	1	5	0-5
number of overmature trees		1	0	5	0-2
stems per acre:					
total live		180	19	5	130-240
Douglas Fir		172	17	5	130-230
oak		2	2	5	0-10
madrone		6	6	5	0-30
snag		36	7	5	20-60
ground cover:					
herbaceous	(in)	79	31	5	7-163
shrub	"	54	26	5	0-150
rock	"	25	9	5	0-51
bare ground	"	5	5	5	0-24
litter	"	466	42	5	306-541
dead & down # 1	"	220	24	5	131-279
# 2	"	51	20	5	20-131
single storied plots:					
dominant species		DF		5	
DBH	(in)	16	0.9	86	6-48
canopy closure	(%)	99	1	5	97-100
tree height	(ft)	148	4	15	133-159
lower canopy height	"	90	5	15	76-104
canopy depth	"	59	2	15	55-64
percent total plots	(%)	100			
multi-storied plots:					
overstory:					
dominant species					
DBH	(in)				
canopy closure	(%)				
tree height	(ft)				
lower canopy height	"				
canopy depth	"				
percent total plots	(%)				
understory:					
dominant species					
DBH	(in)				
canopy closure	(%)				
tree height	(ft)				
lower canopy height	"				
canopy depth	"				

Table 7. Nest stand description for Salt Creek; level 3 analysis.

Variable	Mean/ Mode	Standard error	N	Range
overall stand:				
dominant species	DF		5	
DBH (in)	12	0.6	97	5-47
basal area (ft^2/acre)	368	34	5	240-440
slope (%)	36	4	5	22-44
aspect (deg)	86		5	43-118
altitude (ft)			5	2370-2710
numbers of stories	1		5	1-2
total canopy closure (%)	95	1	5	92-99
CIA decadence	low		5	low-med
area (ac)	39			
number of mature trees	2	0	5	1-3
number of overmature trees	0	0	5	0-1
stems per acre:				
total live	220	26	5	170-320
Douglas Fir	192	2	5	150-260
oak	26	12	5	0-60
madrone	2	2	5	0-10
snag	46	14	5	20-80
ground cover:				
herbaceous (in)	76	28	5	0-143
shrub "	7	6	5	0-32
rock "	12	8	5	0-41
bare ground "	7	2	5	0-14
litter "	430	83	5	149-638
dead & down # 1 "	207	55	5	15-344
# 2 "	161	100	5	0-538
single storied plots:				
dominant species	DF		4	
DBH (in)	12	0.7	81	5-34
canopy closure (%)	95	1	4	92-98
tree height (ft)	119	11	12	88-138
lower canopy height "	69	7	12	57-90
canopy depth "	50	10	12	31-77
percent total plots (%)	80			
multi-storied plots:				
overstory:				
dominant species	DF		1	
DBH (in)	39	7.4	2	32-47
canopy closure (%)	59		1	
tree height (ft)	105	2	3	101-108
lower canopy height "	51	1	3	50-53
canopy depth "	54	7	3	51-59
percent total plots (%)	20			
understory:				
dominant species	DF		1	
DBH (in)	12	1.0	14	6-20
canopy closure (%)	40		1	
tree height (ft)	80	1	3	78-81
lower canopy height "	34	6	3	22-43
canopy depth "	46	6	3	38-57

Table 8. Nest stand description for Slate Creek; level 3 analysis.

Variable		Mean/ Mode	Standard error	N	Range
overall stand:					
dominant species		DF		6	
DBH	(in)	19	0.8	73	6-35
basal area (ft^2/acre)		393	44	6	200-520
slope	(%)	46	3	6	36-56
aspect	(deg)	89		6	73-98
altitude	(ft)			6	1620-1895
numbers of stories		1		6	1
total canopy closure	(%)	97	0	6	95-97
CIA decadence		low		6	low
area	(ac)	28			
number of mature trees		5	1	6	2-6
number of overmature trees		0	0	6	0-1
stems per acre:					
total live		138	14	6	100-190
Douglas Fir		122	11	6	100-170
oak		5	2	6	0-10
madrone		12	5	6	0-30
snag		25	4	6	10-40
ground cover:					
herbaceous	(in)	82	36	6	0-249
shrub	"	53	29	6	0-181
rock	"	7	3	6	1-18
bare ground	"	5	2	6	0-11
litter	"	529	95	6	232-810
dead & down # 1	"	226	75	6	22-433
# 2	"	28	9	6	13-72
single storied plots:					
dominant species		DF		6	
DBH	(in)	19	0.8	73	6-35
canopy closure	(%)	96	1	6	93-97
tree height	(ft)	137	5	30	121-155
lower canopy height	"	101	6	30	78-117
canopy depth	"	36	3	30	26-44
percent total plots	(%)	100			
multi-storied plots:					
overstory:					
dominant species					
DBH	(in)				
canopy closure	(%)				
tree height	(ft)				
lower canopy height	"				
canopy depth	"				
percent total plots	(%)				
understory:					
dominant species					
DBH	(in)				
canopy closure	(%)				
tree height	(ft)				
lower canopy height	"				
canopy depth	"				

Table 9. Nest stand description for Coffee Pot; level 3 analysis.

Variable	Mean/ Mode	Standard error	N	Range
overall stand:				
dominant species	DF		5	
DBH (in)	23	1.2	60	7-48
basal area (ft^2/acre)	440	13	5	400-480
slope (%)	23	4	5	13-36
aspect (deg)	238		5	192-292
altitude (ft)			5	3340-3410
numbers of stories	1		5	1
total canopy closure (%)	93	1	5	90-95
CIA decadence	low		5	low-med
area (ac)	5			
number of mature trees	7	1	5	5-8
number of overmature trees	1	1	5	0-3
stems per acre:				
total live	126	12	5	110-170
Douglas Fir	120	9	5	100-150
oak	4	4	5	0-20
madrone	0		5	0
snag	56	12	5	30-100
ground cover:				
herbaceous (in)	0	0	5	0-2
shrub "	71	24	5	0-131
rock "	6	2	5	0-12
bare ground "	0	0	5	0
litter "	345	27	5	248-399
dead & down # 1 "	422	27	5	370-508
# 2 "	56	25	5	0-132
single storied plots:				
dominant species	DF		5	
DBH (in)	23	1.2	60	7-48
canopy closure (%)	93	1	5	90-95
tree height (ft)	160	8	15	135-181
lower canopy height "	101	3	15	92-110
canopy depth "	59	6	15	43-75
percent total plots (%)	100			
multi-storied plots:				
overstory:				
dominant species				
DBH (in)				
canopy closure (%)				
tree height (ft)				
lower canopy height "				
canopy depth "				
percent total plots (%)				
understory:				
dominant species				
DBH (in)				
canopy closure (%)				
tree height (ft)				
lower canopy height "				
canopy depth "				

Table 10. Nest stand description for Hoaglin; level 3 analysis.

Variable		Mean/ Mode	Standard error	N	Range
overall stand:					
dominant species		DF		9	
DBH	(in)	14	0.9	247	5-39
basal area (ft^2/acre)		409	32	9	240-560
slope	(%)	24	4	9	4-40
aspect	(deg)	133		9	15-266
altitude	(ft)			9	2380-2480
numbers of stories		1		9	1-2
total canopy closure	(%)	92	1	9	89-95
CIA decadence		low		9	low
area	(ac)	22			
number of mature trees		3	1	9	2-6
number of overmature trees		0	0	9	0-1
stems per acre:					
total live		269	23	9	160-400
Douglas Fir		268	24	9	160-400
oak		1	1	9	0-10
madrone		0		9	0
snag		43	6	9	10-70
ground cover:					
herbaceous	(in)	17	10	9	0-97
shrub	"	13	9	9	0-81
rock	"	1	1	9	0-6
bare ground	"	4	1	9	0-12
litter	"	392	25	9	275-496
dead & down # 1	"	444	43	9	171-610
# 2	"	29	10	9	0-89
single storied plots:					
dominant species		DF		8	
DBH	(in)	14	0.4	231	5-39
canopy closure	(%)	92	1	8	89-95
tree height	(ft)	142	6	24	117-166
lower canopy height	"	96	4	24	79-113
canopy depth	"	46	2	24	33-53
percent total plots	(%)	89			
multi-storied plots:					
overstory:					
dominant species		DF		1	
DBH	(in)	36		2	35-38
canopy closure	(%)	27		1	
tree height	(ft)	160	14	3	132-176
lower canopy height	"	102	6	3	90-110
canopy depth	"	58	8	3	42-47
percent total plots	(%)	11			
understory:					
dominant species		DF		1	
DBH	(in)	11	1.1	14	5-20
canopy closure	(%)	64		1	
tree height	(ft)	118	7	3	109-131
lower canopy height	"	80	6	3	70-92
canopy depth	"	37	4	3	30-44

Table 11. Control stand description for Long unit 5; level 3 analysis.

Variable	Mean/ Mode	Standard error	N	Range
overall stand:				
dominant species	DF		10	
DBH (in)	19	0.6	136	5-42
basal area (ft^2/acre)	372	23	10	240-480
slope (%)	12	2	10	1-24
aspect (deg)	74		10	8-260
altitude (ft)			10	3090-3130
numbers of stories	1		10	1-2
total canopy closure (%)	78	1	10	72-82
CIA decadence	low		10	low
area (ac)	15			
number of mature trees	5	0	10	3-7
number of overmature trees	1	0	10	0-2
stems per acre:				
total live	150	20	10	90-280
Douglas Fir	136	13	10	90-200
oak	2	2	10	0-20
madrone	2	1	10	0-10
snag	54	9	10	20-100
ground cover:				
herbaceous (in)	37	12	10	0-111
shrub "	16	10	10	0-97
rock "	0	0	10	0-1
bare ground "	3	1	10	0-10
litter "	432	44	10	194-614
dead & down # 1 "	315	34	10	143-479
# 2 "	98	18	10	31-222
single storied plots:				
dominant species	DF		8	
DBH (in)	19	0.7	110	5-38
canopy closure (%)	78	1	8	72-82
tree height (ft)	146	3	24	136-161
lower canopy height "	86	5	24	75-112
canopy depth "	60	6	24	24-79
percent total plots (%)	80			
multi-storied plots:				
overstory:				
dominant species	DF		2	
DBH (in)	32	1.9	11	19-42
canopy closure (%)	54	19	2	35-73
tree height (ft)	135	3	6	132-138
lower canopy height "	67	2	6	65-68
canopy depth "	69	2	6	67-70
percent total plots (%)	20			
understory:				
dominant species	DF		2	
DBH (in)	12	1.2	15	5-19
canopy closure (%)	24		2	4-44
tree height (ft)	70	37	6	33-108
lower canopy height "	37	19	6	19-56
canopy depth "	33	19	6	14-52

Table 12. Control stand description for Long unit 21; level 3 analysis.

Variable		Mean/ Mode	Standard error	N	Range
overall stand:					
dominant species		DF		9	
DBH	(in)	12	0.4	175	5-55
basal area	(ft^2/acre)	316	17	9	140-290
slope	(%)	25	4	9	14-51
aspect	(deg)	84		9	35-118
altitude	(ft)			9	2735-2805
numbers of stories		2		9	1-2
total canopy closure	(%)	81	1	9	76-87
CIA decadence		low		9	low-med
area	(ac)	24			
number of mature trees		3	1	9	0-6
number of overmature trees		0	0	9	0-2
stems per acre:					
total live		229	18	9	140-290
Douglas Fir		194	18	9	130-290
oak		16	7	9	0-70
madrone		17	6	9	0-50
snag		18	5	9	0-40
ground cover:					
herbaceous	(in)	36	9	9	1-79
shrub	"	56	20	9	0-166
rock	"	1	1	9	0-8
bare ground	"	2	1	9	0-12
litter	"	521	24	9	443-661
dead & down # 1	"	260	26	9	172-390
# 2	"	24	4	9	8-43
single storied plots:					
dominant species		DF		3	
DBH	(in)	11	0.7	70	5-30
canopy closure	(%)	82	3	3	77-86
tree height	(ft)	125	7	9	113-138
lower canopy height	"	74	9	9	65-92
canopy depth	"	50	3	9	46-56
percent total plots	(%)	33			
multi-storied plots:					
overstory:					
dominant species		DF		6	
DBH	(in)	28	1.9	26	13-55
canopy closure	(%)	56	6	6	26-68
tree height	(ft)	118	3	18	103-128
lower canopy height	"	65	4	18	48-79
canopy depth	"	53	2	18	46-62
percent total plots	(%)	67			
understory:					
dominant species		DF		6	
DBH	(in)	8	0.2	79	5-14
canopy closure	(%)	25	7	6	11-61
tree height	(ft)	56	5	18	46-77
lower canopy height	"	31	3	18	22-40
canopy depth	"	26	3	18	18-37

Table 13. Control stand description for Marshall Rock; level 3 analysis.

Variable	Mean/ Mode	Standard error	N	Range
overall stand:				
dominant species	DF		10	
DBH (in)	15	0.5	188	7-34
basal area (ft^2/acre)	404	33	10	280-640
slope (%)	25	2	10	15-33
aspect (deg)	91		10	56-116
altitude (ft)			10	2920-3050
numbers of stories	1		10	1-2
total canopy closure (%)	80	1	10	76-84
CIA decadence	low		10	low-med
area (ac)	14			
number of mature trees	5	1	10	1-7
number of overmature trees	0	0	10	0-1
stems per acre:				
total live	206	19	10	80-270
Douglas Fir	189	19	10	70-260
oak	13	3	10	0-30
madrone	1	1	10	0-10
snag	74	11	10	20-130
ground cover:				
herbaceous (in)	16	7	10	0-61
shrub "	5	2	10	0-24
rock "	9	4	10	0-36
bare ground "	1	1	10	0-9
litter "	479	39	10	309-647
dead & down # 1 "	333	33	10	200-486
# 2 "	57	14	10	5-111
single storied plots:				
dominant species	DF		9	
DBH (in)	15	0.5	176	5-34
canopy closure (%)	81	1	9	76-84
tree height (ft)	157	5	27	125-175
lower canopy height "	90	3	27	74-100
canopy depth "	66	3	27	49-76
percent total plots (%)	90			
multi-storied plots:				
overstory:				
dominant species	DF		1	
DBH (in)	25	1.1	6	20-27
canopy closure (%)	65		1	
tree height (ft)	137	15	3	118-167
lower canopy height "	70	5	3	60-76
canopy depth "	67	13	3	45-91
percent total plots (%)	10			
understory:				
dominant species	DF		1	
DBH (in)	10	1.1	6	7-13
canopy closure (%)	12		1	
tree height (ft)	87	12	3	63-102
lower canopy height "	41	4	3	32-45
canopy depth "	46	8	3	31-57

ble 14. Control stand description for Wildcat unit; level 3 analysis.

Variable	Mean/ Mode	Standard error	N	Range
overall stand:				
dominant species	DF		5	
DBH (in)	13	0.6	102	5-67
basal area (ft^2/acre)	352	32	5	280-440
slope (%)	30	5	5	14-40
aspect (deg)	16		5	359-24
altitude (ft)			5	3805-3890
numbers of stories	1		5	1-2
total canopy closure (%)	85	1	5	83-87
CIA decadence	low		5	low
area (ac)	38			
number of mature trees	3	0	5	2-3
number of overmature trees	0	0	5	0-1
stems per acre:				
total live	212	19	5	150-260
Douglas Fir	204	17	5	150-250
oak	4	2	5	0-10
madrone	2	2	5	0-10
snag	22	6	5	0-30
ground cover:				
herbaceous (in)	17	10	5	0-54
shrub "	80	53	5	4-276
rock "	20	9	5	3-55
bare ground "	3	2	5	0-12
litter "	422	22	5	361-487
dead & down # 1 "	336	34	5	217-426
# 2 "	23	8	5	0-48
single storied plots:				
dominant species	DDF		4	
DBH (in)	12	0.7	87	5-33
canopy closure (%)	85	1	4	83-87
tree height (ft)	139	7	12	125-155
lower canopy height "	73	5	12	64-88
canopy depth "	66	4	12	59-76
percent total plots (%)	80			
multi-storied plots:				
overstory:				
dominant species	DF		1	
DBH (in)	41	12.6	3	25-67
canopy closure (%)	48		1	
tree height (ft)	143	6	3	132-150
lower canopy height "	71	5	3	62-78
canopy depth "	73	2	3	70-76
percent total plots (%)	20			
understory:				
dominant species	DF		1	
DBH (in)	7	0.6	12	5-11
canopy closure (%)	39		1	
tree height (ft)	73	9	3	57-89
lower canopy height "	43	5	3	33-49
canopy depth "	30	5	3	23-41

Table 15. Control stand description for Grace unit 7; level 3 analysis.

Variable	Mean/ Mode	Standard error	N	Range
overall stand:				
dominant species	DF		5	
DBH (in)	17	0.7	86	5-34
basal area (ft^2/acre)	432	20	5	400-480
slope (%)	50	2	5	42-56
aspect (deg)	42		5	18-78
altitude (ft)			5	3315-3470
numbers of stories	1		5	1-2
total canopy closure (%)	89	1	5	87-91
CIA decadence	low		5	low
area (ac)	62			
number of mature trees	5	1	5	4-7
number of overmature trees	0		5	0
stems per acre:				
total live	176	14	5	130-210
Douglas Fir	172	17	5	110-210
oak	4	4	5	0-20
madrone	0		5	0
snag	36	12	5	0-70
ground cover:				
herbaceous (in)	64	23	5	3-139
shrub "	5	2	5	0-12
rock "	22	8	5	4-52
bare ground "	6	2	5	0-10
litter "	338	31	5	269-435
dead & down # 1 "	436	24	5	349-489
# 2 "	29	7	5	8-46
single storied plots:				
dominant species	DF		4	
DBH (in)	17	0.8	75	5-34
canopy closure (%)	89	1	4	87-91
tree height (ft)	142	5	12	132-156
lower canopy height "	81	2	12	77-85
canopy depth "	60	7	12	48-78
percent total plots (%)	80			
multi-storied plots:				
overstory:				
dominant species	DF		1	
DBH (in)	26	1.9	7	21-33
canopy closure (%)	82		1	
tree height (ft)	137	7	3	122-145
lower canopy height "	79	8	3	65-92
canopy depth "	58	3	3	53-64
percent total plots (%)	20			
understory:				
dominant species	DF		1	
DBH (in)	11	1.2	4	8-14
canopy closure (%)	9		1	
tree height (ft)	70	7	3	57-77
lower canopy height "	40	4	3	31-45
canopy depth "	30	2	3	25-32

Table 16. Control stand description for Grace Unit 9; level 3 analysis.

Variable		Mean/ Mode	Standard error	N	Range
overall stand:					
dominant species		DF		10	
DBH	(in)	15	0.6	167	5-34
basal area (ft^2/acre)		404	31	10	200-560
slope	(%)	51	3	10	30-60
aspect	(deg)	342		10	303-24
altitude	(ft)			10	3190-3400
numbers of stories		1		10	1-2
total canopy closure	(%)	89	1	10	87-91
CIA decadence		low		10	low
area	(ac)	28			
number of mature trees		5	0	10	3-7
number of overmature trees		0		10	0
stems per acre:					
total live		174	23	10	50-280
Douglas Fir		167	2	10	50-270
oak		5	2	10	0-20
madrone		2	1	10	0-10
snag		20	7	10	0-60
ground cover:					
herbaceous	(in)	16	12	10	0-121
shrub	"	11	7	10	0-64
rock	"	30	10	10	1-109
bare ground	"	12	3	10	0-29
litter	"	421	26	10	317-542
dead & down # 1	"	370	31	10	212-518
# 2	"	39	13	10	0-139
single storied plots:					
dominant species		DF		9	
DBH	(in)	15	0.6	153	5-34
canopy closure	(%)	92	1	9	87-94
tree height	(ft)	141	4	27	115-156
lower canopy height	"	87	3	27	69-95
canopy depth	"	54	2	27	47-65
percent total plots	(%)	90			
multi-storied plots:					
overstory:					
dominant species		DF		1	
DBH	(in)	25	1.6	10	18-31
canopy closure	(%)	80		1	
tree height	(ft)	154	6	3	144-164
lower canopy height	"	90	7	3	76-100
canopy depth	"	64	5	3	55-70
percent total plots	(%)	10			
understory:					
dominant species		DF		1	
DBH	(in)	10	1.1	4	8-13
canopy closure	(%)	11		1	
tree height	(ft)	71	7	3	62-86
lower canopy height	"	38	2	3	35-42
canopy depth	"	33	8	3	19-47

Table 17. Control stand description for Secret Unit 15; level 3 analysis.

Variable	Mean/ Mode	Standard error	N	Range
overall stand:				
dominant species	DF		5	
DBH (in)	14	0.7	93	5-31
basal area (ft^2/acre)	368	20	5	320-400
slope (%)	31	3	5	24-39
aspect (deg)	56		5	22-70
altitude (ft)			5	3360-3395
numbers of stories	1		5	1
total canopy closure (%)	91	0	5	90-92
CIA decadence	low		5	low
area (ac)	15			
number of mature trees	3	0	5	3-5
number of overmature trees	0		5	0
stems per acre:				
total live	212	24	5	130-260
Douglas Fir	186	15	5	130-210
oak	3	1	5	0-50
madrone	0		5	0
snag	50	9	5	30-80
ground cover:				
herbaceous (in)	21	14	5	2-77
shrub "	19	11	5	0-47
rock "	8	4	5	1-23
bare ground "	1	1	5	0-5
litter "	490	22	5	414-533
dead & down # 1 "	299	12	5	254-315
# 2 "	61	11	5	37-92
single storied plots:				
dominant species	DF		5	
DBH (in)	14	0.7	93	5-31
canopy closure (%)	91	0	5	90-92
tree height (ft)	151	6	15	133-166
lower canopy height "	92	3	15	86-102
canopy depth "	58	5	15	43-69
percent total plots (%)	100			
multi-storied plots:				
overstory:				
dominant species				
DBH (in)				
canopy closure (%)				
tree height (ft)				
lower canopy height "				
canopy depth "				
percent total plots (%)				
understory:				
dominant species				
DBH (in)				
canopy closure (%)				
tree height (ft)				
lower canopy height "				
canopy depth "				

Table 18. Control stand description for Littlefield Creek; level 3 analysis.

Variable		Mean/ Mode	Standard error	N	Range
overall stand:					
dominant species		DF		8	
DBH	(in)	13	0.5	190	6-47
basal area (ft^2/acre)		410	33	8	280-560
slope	(%)	39	3	8	20-54
aspect	(deg)	57		8	21-114
altitude	(ft)			8	2940-3010
numbers of stories		1		8	1-2
total canopy closure	(%)	91	1	8	88-93
CIA decadence		low		8	low
area	(ac)	41			
number of mature trees		3	1	8	1-5
number of overmature trees		1	0	8	0-2
stems per acre:					
total live		243	23	8	150-340
Douglas Fir		235	2	8	140-330
oak		6	2	8	0-10
madrone		1	1	8	0-10
snag		79	6	8	60-110
ground cover:					
herbaceous	(in)	8	3	8	0-27
shrub	"	55	24	8	0-184
rock	"	23	3	8	11-35
bare ground	"	1	1	8	0-3
litter	"	337	31	8	240-482
dead & down # 1	"	419	19	8	344-498
# 2	"	56	13	8	34-144
single storied plots:					
dominant species		DF		6	
DBH	(in)	13	0.6	151	6-47
canopy closure	(%)	92	1	6	88-93
tree height	(ft)	136	3	18	129-149
lower canopy height	"	86	1	18	83-90
canopy depth	"	49	3	18	43-61
percent total plots	(%)	75			
multi-storied plots:					
overstory:					
dominant species		DF		2	
DBH	(in)	34	2	4	31-38
canopy closure	(%)	50	22	2	28-72
tree height	(ft)	180	11	5	169-191
lower canopy height	"	105	6	5	99-110
canopy depth	"	76	5	5	70-81
percent total plots	(%)	25			
understory:					
dominant species		DF		2	
DBH	(in)	11	0.8	35	6-25
canopy closure	(%)	41	23	2	18-64
tree height	(ft)	138	2	6	136-140
lower canopy height	"	87	4	6	83-91
canopy depth	"	51	2	6	49-53

Table 19. Control stand description for Secret Unit 19; level 3 analysis.

Variable		Mean/ Mode	Standard error	N	Range
overall stand:					
dominant species		DF		6	
DBH	(in)	15	0.5	149	6-31
basal area (ft^2/acre)		447	12	6	400-480
slope	(%)	37	2	6	31-743
aspect	(deg)	52		6	31-78
altitude	(ft)			6	2965-3020
numbers of stories		1		6	1-2
total canopy closure	(%)	93	1	6	88-96
CIA decadence		low		6	low
area	(ac)	12		6	
number of mature trees		4	1	6	1-8
number of overmature trees		0		6	0
stems per acre:					
total live		247	24	6	160-320
Douglas Fir		245	24	6	160-320
oak		2	2	6	0-10
madrone		0		6	0
snag		55	12	6	20-90
ground cover:					
herbaceous	(in)	12	5	6	0-31
shrub	"	3	1	6	0-8
rock	"	6	2	6	0-15
bare ground	"	2	1	6	0-6
litter	"	345	19	6	287-422
dead & down # 1	"	488	21	6	415-553
# 2	"	45	13	6	14-102
single storied plots:					
dominant species		DF		5	
DBH	(in)	14	1	133	6-30
canopy closure	(%)	93	2	5	88-96
tree height	(ft)	145	8	15	116-162
lower canopy height	"	92	3	15	82-101
canopy depth	"	52	6	15	34-69
percent total plots	(%)	83			
multi-storied plots:					
overstory:					
dominant species		DF		1	
DBH	(in)	23	1.4	11	18-31
canopy closure	(%)	77		1	
tree height	(ft)	133	5	3	122-140
lower canopy height	"	98	4	3	92-105
canopy depth	"	35	3	3	30-41
percent total plots	(%)	17			
understory:					
dominant species		DF		1	
DBH	(in)	11	0.8	5	8-12
canopy closure	(%)	13		1	
tree height	(ft)	101	5	3	93-110
lower canopy height	"	62	3	3	57-67
canopy depth	"	39	7	3	31-53

Table 20. Control stand description for Browns unit 6; level 3 analysis.

Variable		Mean/ Mode	Standard error	N	Range
overall stand:					
dominant species		DF		6	
DBH	(in)	15	0.5	125	6-28
basal area (ft^2/acre)		387	32	6	280-480
slope	(%)	20	3	6	13-30
aspect	(deg)	356		6	344-10
altitude	(ft)			6	2905-2930
numbers of stories		1		6	1
total canopy closure	(%)	92	1	6	90-95
CIA decadence		low		6	low
area	(ac)	18			
number of mature trees		5	0	6	4-5
number of overmature trees		0		6	0
stems per acre:					
total live		212	22	6	130-280
Douglas Fir		208	21	6	130-270
oak		3	2	6	0-10
madrone		0		6	0
snag		53	16	6	10-110
ground cover:					
herbaceous	(in)	20	8	6	0-53
shrub	"	5	3	6	0-17
rock	"	5	2	6	1-16
bare ground	"	2	2	6	0-7
litter	"	355	33	6	269-469
dead & down # 1	"	376	37	6	276-482
# 2	"	137	36	6	47-273
single storied plots:					
dominant species		DF		6	
DBH	(in)	15	0.5	125	6-28
canopy closure	(%)	92	1	6	90-95
tree height	(ft)	148	5	18	136-161
lower canopy height	"	99	3	18	89-107
canopy depth	"	49	3	18	41-62
percent total plots	(%)	100			
multi-storied plots:					
overstory:					
dominant species					
DBH	(in)				
canopy closure	(%)				
tree height	(ft)				
lower canopy height	"				
canopy depth	"				
percent total plots	(%)				
understory:					
dominant species					
DBH	(in)				
canopy closure	(%)				
tree height	(ft)				
lower canopy height	"				
canopy depth	"				